OMRON

Displacement Sensor

Confocal Fiber Type

ZW Series

User's Manual

Cat. No. Z322-E1-01A

Introduction

This manual provides information regarding functions, performance and operating methods that are required for using the ZW Series.

- The ZW Displacement Sensor must be operated by personnel knowledgeable in electrical engineering.
- To ensure correct use, please read this manual thoroughly to deepen your understanding of the product.
- Please keep this manual in a safe place so that it can be referred to whenever necessary.

INTRODUCTION	APPLICATION CONSIDERATIONS (Please Read)
Chapter 1	MEASUREMENT SETUP
Chapter 2	BASIC OPERATION
Chapter 3	SETTINGS FOR FUNCTIONS
Chapter 4	I/O SETTINGS
Chapter 5	Ethernet/RS-232C COMMUNICATION
Chapter 6	SPECIFICATIONS AND EXTERNAL DIMENSIONS
Chapter 7	APPENDIX

User's Manual

Confocal Fiber Displacement Sensor
ZW Series

READ AND UNDERSTAND THIS DOCUMENT

Please read and understand this document before using the products. Please consult your OMRON representative if you have any questions or comments.

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.

- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

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It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the product may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

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The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

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Meanings of Signal Words

The following signal words are used in this manual.

⚠ Warning	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

Meanings of Alert Symbols

The following alert symbols are used in this manual.

	Indicates general prohibitions for which there is no specific symbol.
	Indicates prohibition when there is a risk of minor injury from electrical shock or other source if the product is disassembled.
	Indicates the possibility of fire under specific conditions.
	Indicates the possibility of explosion under specific conditions.
	Indicates the possibility of LED radiation.

Meanings of Alert Symbols

The following alert symbols are used in this manual.

⚠ Warning	
This product is not designed or rated for ensuring safety of persons. Do not use it for such purposes.	
Doing so may cause high-voltage section to be exposed, resulting in the electrical shock, and may cause burn from a high temperature. Never attempt to disassemble, repair, modify, apply pressure to deform or burn up the body.	

⚠ Caution	
Doing so may cause breakdown or ignition. Do not operate the product in excess of the rated voltage.	
Doing so may cause an explosion. Never operate the product with an AC power supply.	
If you keep looking at LED light, in rare cases visual impairment may occur. Do not look directly at LED light.	

Precautions for Safe Use

Please observe the following precautions for safe use of the products.

(1) Installation Environment

- Do not use the product in environments where it can be exposed to inflammable/ explosive gas.
- To secure the safety of operation and maintenance, do not install the product close to high-voltage devices and power devices.

(2) Power Supply and Wiring

- Take care when using a power supply with an overcurrent detector, because this sensor uses DC-DC converter for its power supply circuit and inrush current may activate the protective circuit for a power supply with an overcurrent detector. Recommended power supply: S8VS-06024 (Omron, DC24 V 2.5 A 60 W)
- The supply voltage must be within the rated range (DC24 V ± 10 %).
- Reverse connection of the power supply is not allowed.
- Open-collector outputs should not be short-circuited.
- Use the power supply within the rated load.
- High-voltage lines and power lines must be wired separately from this product. Wiring them together or placing them in the same duct may cause induction, resulting in malfunction or damage.
- Use adequate safety measures, for example fail-safe circuits.
- Attach a specified-sized crimp-type terminal at the end of a wire. Do not connect a wire with an only twisted end directly to a power supply or terminal block.
- For a power supply, use a DC power supply unit provided with a remedy, for example, safety ultralow voltage circuit, to prevent a high voltage from being generated.
- Route so that power supply wires are as short as possible.
- Use D-type grounding (ground resistance of 100 Ω or less). Make the ground point as close as possible and make the ground wire used as short as possible.
- Never a ground wire with other equipment and never ground to building beams. Doing so could cause negative impacts.
- Use a power supply dedicated for this product, without sharing it with other products.
- Tighten fixing screws securely at a torque specified in this manual.
- Before performing any of the following activities, be sure to turn off the product, or breakdown may result.
  - Connecting or wiring cables
  - Connecting or disconnecting connectors
  - Installing or removing Calibration ROM

(3) Others

- Do not use this product for nuclear facilities, or safety circuits involving human lives.
- Do not attempt to disassemble, repair, modify, apply pressure to deform or burn up the body.
- Dispose of this product as industrial waste.

- Use exclusive devices, including a sensor head, Calibration ROM, fiber cable or RS-232C cable, to connect, or ignition, burst, false operation or breakdown may be caused.
- Do not cut fiber cable. Glass at the cut section may cause injury. Also, if cut, it will not work normally anymore.
- Whenever any trouble, including, strange odor smelled, the body overheated or smoke escaped, was found, immediately stop the operation, and consult an OMRON branch or sales office with the system shut down.
- Do not drop or make a strong impact on the unit.
- Before using any equipment provided with a lock mechanism, make sure that it has been locked.

(4) Regulations and Standards

This sensor conforms to the following EMC directive and EN standard:

- EMC directive, No. 2004, 108, EC
- EN standard, EN61326

(5) Notice for Korea Radio Law

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지역에서 사용하는 것을 목적으로 합니다.

Precautions for Correct Use

Please observe the following precautions to prevent failure to operate, malfunctions, or undesirable effects on product performance.

(1) Installation Site

Do not install the product in locations subjected to the following conditions:

- Ambient temperature outside the rating
- Rapid temperature fluctuations (causing condensation)
- Relative humidity outside the range of 35 to 85 %
- Presence of corrosive or flammable gases
- Presence of dust, salt, or iron particles
- Direct vibration or shock
- Reflection of intense light (such as other laser beams, electric arc-welding machines or ultraviolet shine)
- Direct sunlight or near heaters
- Water, oil, or chemical fumes, spray or mist atmospherics
- Strong magnetic or electric field

(2) Power Supply and Wiring

- When using a commercially available switching regulator, make sure that the FG terminal is grounded.
- If surge currents are present in the power lines, connect surge absorbers that suit the operating environment.
- Before turning ON the power after the product is connected, make sure that the power supply voltage is correct, there are no incorrect connections (e.g. load short-circuit) and the load current is appropriate. Incorrect wiring may result in breakdown of the product.
- Use the specified voltage. If voltage exceeding the rating or AC voltage is applied, circuit parts may be burnt or rupture.
- Use the Extension Fiber Cable (ZW-XF_ _R) for extending the fiber cable between the Sensor extension fiber cable, five total lengths, 2, 5, 10, 20 or 30 m, are available.
- Handling fiber cables
  Use them in compliance with the following.
  -Fiber cable bend radiuses must be at least 20 mm.
  - Do not let bending cause stress at the root section of a fiber connector.
  -Do not yank hard on a fiber cable.
  -Do not step on a fiber cable or place anything heavy on it.
- Be sure to use a Sensor Head and Calibration ROM with the same serial number. A pair with different serial numbers cannot operate normally.
- Use the configuration software with the combination specified in this manual, or the system may operate faultily.
- Do not shut down the power supply when saving any data into the memory built in the controller, or the data may be corrupted.

- While a fiber cable is disconnected, be sure to attach the included protective cap on both the controller side and the fiber cable side. Leaving the fiber cable with the protective cap not attached, the optical fiber may fail due to any adhered foreign matter.

(3) Warming Up

After turning ON the power supply, allow the product to stand for at least 30 minutes before use. The circuits are still unstable immediately after the power supply is turned ON, so measured values may fluctuate gradually.

(4) Maintenance and Inspection

Do not use thinner, benzene, acetone or kerosene to clean the Sensor Head, fiber cable and controller. If large dust particles adhere to the emitter/receiver of the Sensor Head or controller, use a blower brush (used to clean camera lenses) to blow them off. Do not blow the dust particles with your mouth.

To remove smaller dust particles, dirt, oil, and fat, wipe gently with a soft cloth (for cleaning lenses). Do not use excessive force to wipe off dust particles. Scratches on the emitter/receiver may cause false operations or measuring errors.

For details on the method for cleaning the ends of fiber cables, refer to "Connecting Fiber Cables" (p.1-15).

(5) Sensing Objects

The product sometimes cannot accurately measure the following types of objects: Transparent objects, objects with an extremely low reflection factor, objects smaller than the spot diameter, objects with a large curvature, excessively inclined objects, target objects with a thin film on the surface etc.

(6) Effect caused by peripheral lights

Do not install the Sensor Head in a place where strong light hits the laser emitter/receiver section of the Sensor Head. Also, if a workpiece has a shiny surface, the light from the lighting will be reflected and a malfunction may occur. In such a case, prevent reflection by, for example, covering the light to stop reflection.

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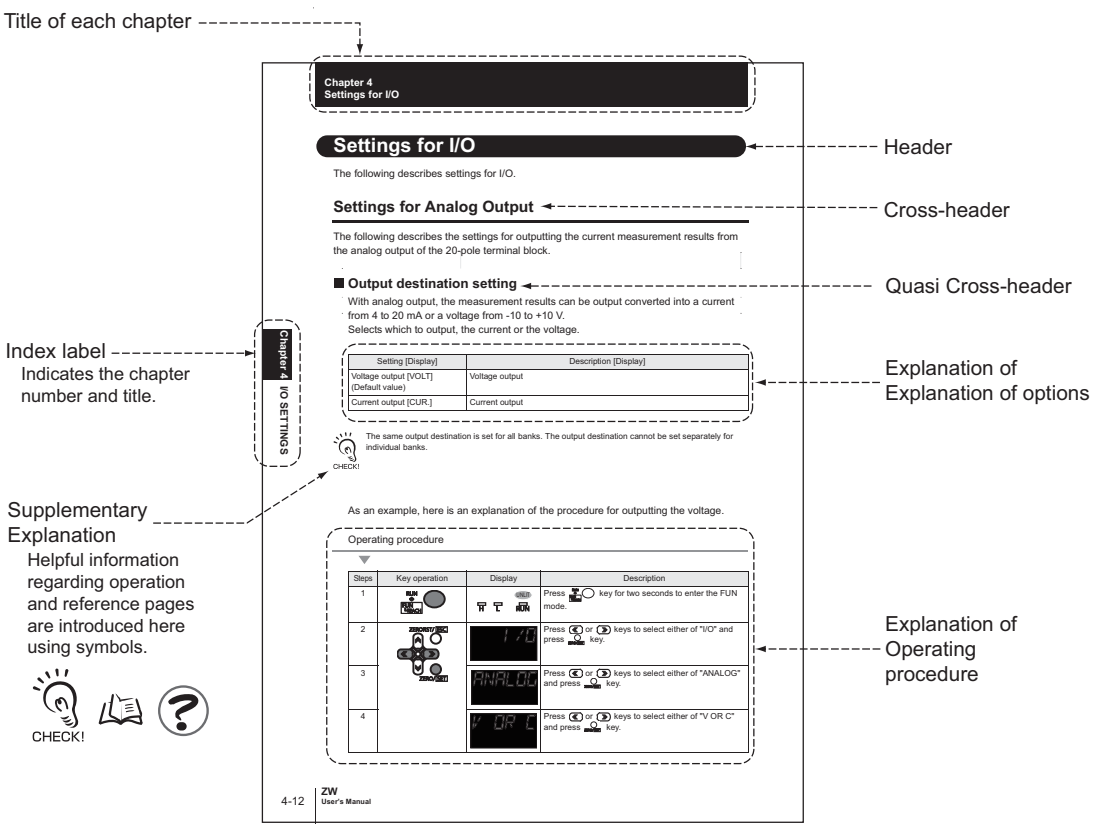
(7) Influence by Air Turbulences

Slow air turbulences around the Sensor Head may disperse measured values.

To avoid these possible air turbulences, wrap the Sensor Head with an appropriate cover.

Editor's Note

Page Format



■ Meaning of Symbols

Menu items that are displayed on the main or sub-display, and windows, dialog boxes and other GUI elements displayed on the personal computer are indicated enclosed by brackets [ ].

■ Visual Aids

Mark	Means
CHECK!	Indicates points that are important to ensure full product performance, such as operational precautions and application procedures.
	Indicates pages where related information can be found.
	Indicates information helpful in operation.
Optional	Indicates that the setting is optional in a configuration procedure.

Notice

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- Please understand that the specifications and other contents of this manual are subject to change for improvement without notice.
- Every effort has been made to ensure the accuracy of the contents of this manual, but if you should notice any mistake, questionable section, or the like in this manual, please contact an OMRON branch or sales office.
- If you do so, please also tell us the manual number, which is found at the end of the manual.

Related Manuals

The following manual is related to the ZW series. Use this manual for reference.

Manual name	Cat. No.	Model numbers	Application	Description
Smart Monitor ZW Operation manual	Z323-E1-01	ZW-SW_ _	To learn about the operation methods and functions of the Smart Monitor ZW	This describes the operation methods for the Smart Monitor ZW.

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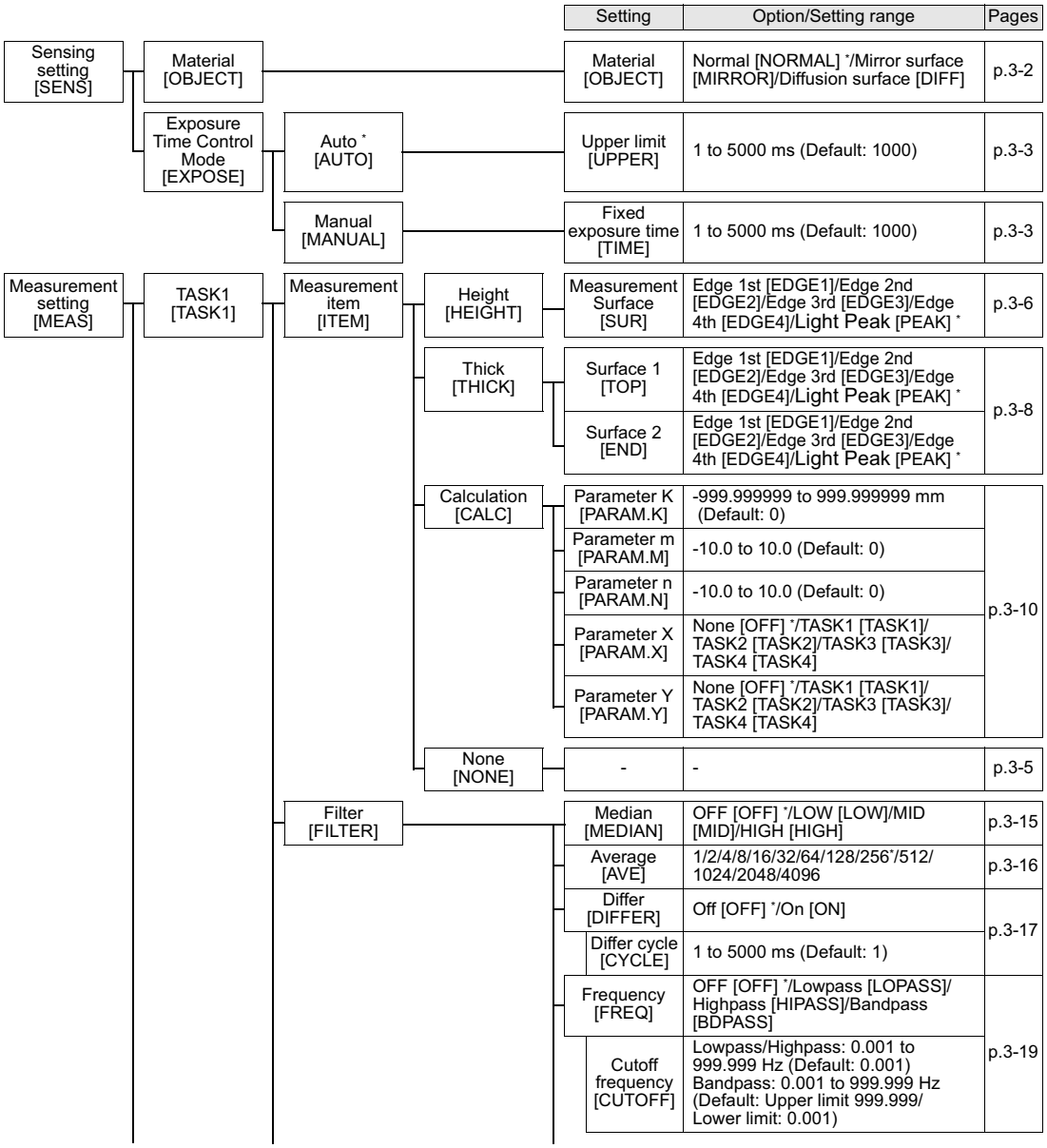
■FUN mode

* - Default value



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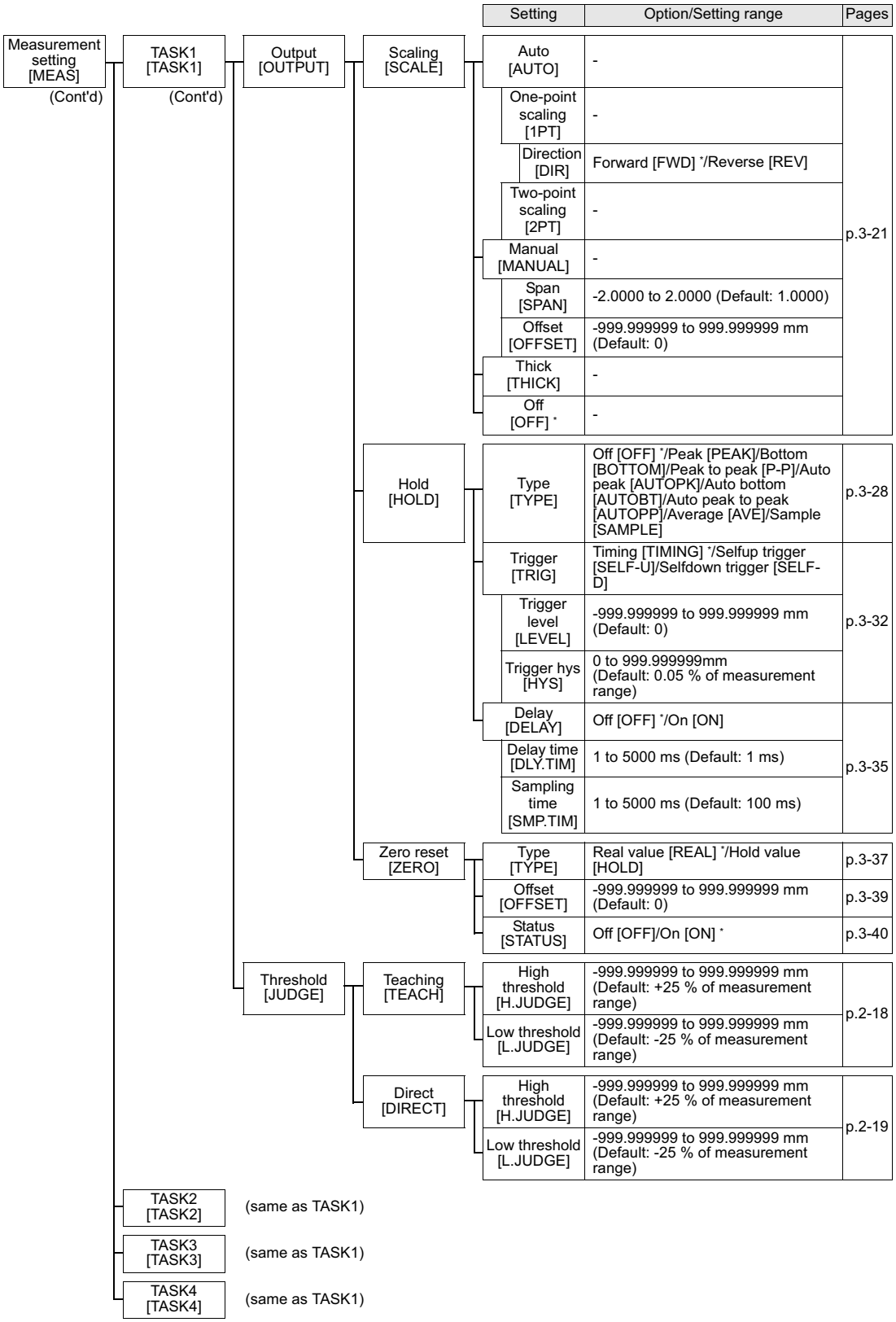
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(Cont'd)
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(same as TASK1)
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			Setting	Option/Setting range	Pages
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			Analog output [ANALOG]	Current output: MIN [MIN] (Approx. 3.4 mA)/4 mA/5 mA/.../19 mA/20 mA/MAX [MAX] (Approx. 21 mA) (Default: MAX) Voltage output: MIN [MIN] (Approx. -10.8 V)/-10 V/-9 V/.../9 V/ 10 V/MAX [MAX] (Approx. 10.8 V) (Default: MAX)	p.4-30
			Binary output [BINARY]	MAX [MAX] */MIN [MIN]	
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			Measurement value 1 [MEAS1]	-999.999999 to 999.999999 mm (Default: -0.5)	
			Focus Current/ Voltage 2 [CUR2]/ [VOLT2]	Current: 4/5/6/7/8/9/10/11/12/13/14/ 15/16/17/18/19/20 mA (Default: 20 mA) Voltage: -10/-9/-8/-7/-6/-5/-4/-3/-2/-1/0/1/2/3/4/5/6/7/8/9/10 V (Default: 10 V)	
			Measurement value 2 [MEAS2]	-999.999999 to 999.999999 mm (Default: 0.5)	
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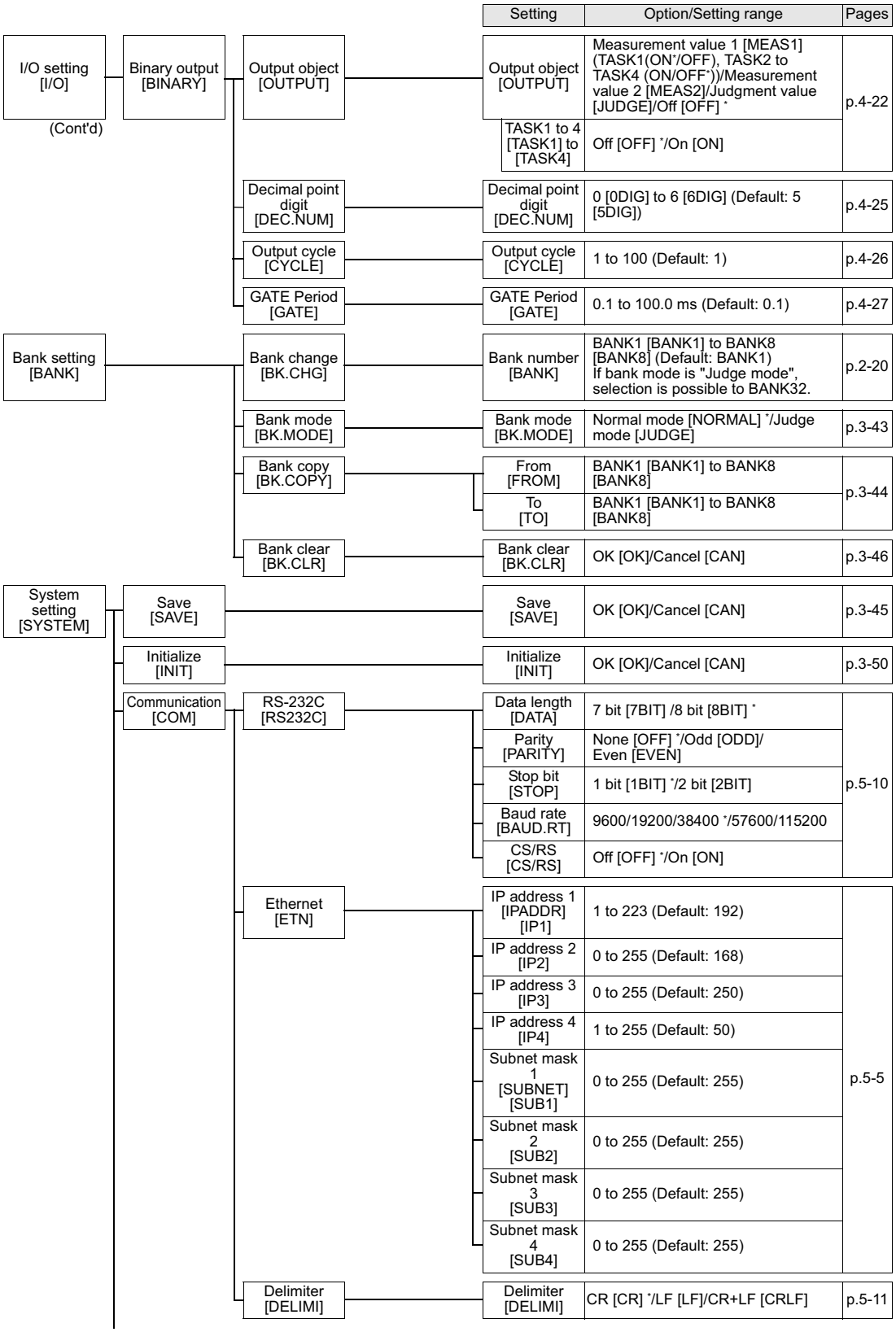
			Calibration value 1 [ADJ1]	-999 to 999 (Default: 0)	
			Calibration Current/ Voltage 2 [CUR2]/ [VOLT2]	Current: 4/5/6/7/8/9/10/11/12/13/14/ 15/16/17/18/19/20 mA (Default: 20 mA) Voltage: -10/-9/-8/-7/-6/-5/-4/-3/-2/-1/0/1/2/3/4/5/6/7/8/9/10 V (Default: 10 V)	
			Calibration value 2 [ADJ2]	-999 to 999 (Default: 0)	

* The same output destination is set for all banks. The output destination cannot be set separately for individual banks.


Setting
Option/Setting range
Pages
I/O setting [I/O]
(Cont'd)
Binary output [BINARY]
Output object [OUTPUT]
Output object [OUTPUT]
Measurement value 1 [MEAS1] (TASK1(ON*/OFF), TASK2 to TASK4 (ON/OFF*))/Measurement value 2 [MEAS2]/Judgment value [JUDGE]/Off [OFF] *
p.4-22
TASK1 to 4 [TASK1] to [TASK4]
Off [OFF] */On [ON]
Decimal point digit [DEC.NUM]
Decimal point digit [DEC.NUM]
0 [0DIG] to 6 [6DIG] (Default: 5 [5DIG])
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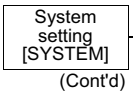
Output cycle [CYCLE]
Output cycle [CYCLE]
1 to 100 (Default: 1)
p.4-26
GATE Period [GATE]
GATE Period [GATE]
0.1 to 100.0 ms (Default: 0.1)
p.4-27
Bank setting [BANK]
Bank change [BK.CHG]
Bank number [BANK]
BANK1 [BANK1] to BANK8 [BANK8] (Default: BANK1)
If bank mode is "Judge mode", selection is possible to BANK32.
p.2-20
Bank mode [BK.MODE]
Bank mode [BK.MODE]
Normal mode [NORMAL] */Judge mode [JUDGE]
p.3-43
Bank copy [BK.COPY]
From [FROM]
BANK1 [BANK1] to BANK8 [BANK8]
p.3-44
To [TO]
BANK1 [BANK1] to BANK8 [BANK8]
Bank clear [BK.CLR]
Bank clear [BK.CLR]
OK [OK]/Cancel [CAN]
p.3-46
System setting [SYSTEM]
Save [SAVE]
Save [SAVE]
OK [OK]/Cancel [CAN]
p.3-45
Initialize [INIT]
Initialize [INIT]
OK [OK]/Cancel [CAN]
p.3-50
Communication [COM]
RS-232C [RS232C]
Data length [DATA]
7 bit [7BIT] /8 bit [8BIT] *
p.5-10
Parity [PARITY]
None [OFF] */Odd [ODD]/ Even [EVEN]
Stop bit [STOP]
1 bit [1BIT] */2 bit [2BIT]
Baud rate [BAUD.RT]
9600/19200/38400 */57600/115200
CS/RS [CS/RS]
Off [OFF] */On [ON]
Ethernet [ETN]
IP address 1 [IPADDR] [IP1]
1 to 223 (Default: 192)
p.5-5
IP address 2 [IP2]
0 to 255 (Default: 168)
IP address 3 [IP3]
0 to 255 (Default: 250)
IP address 4 [IP4]
1 to 255 (Default: 50)
Subnet mask 1 [SUBNET] [SUB1]
0 to 255 (Default: 255)
Subnet mask 2 [SUB2]
0 to 255 (Default: 255)
Subnet mask 3 [SUB3]
0 to 255 (Default: 255)
Subnet mask 4 [SUB4]
0 to 255 (Default: 255)
Delimiter [DELIMI]
Delimiter [DELIMI]
CR [CR] */LF [LF]/CR+LF [CRLF]
p.5-11



		Setting	Option/Setting range	Pages
System setting [SYSTEM] (Cont'd)	Sensor head calibration [H.CALIB]	Sensor head calibration [H.CALIB]	OK [OK]/Cancel [CAN]	p.1-19
	Key lock [LOCK]	Key lock [LOCK]	Off [OFF] */On [ON]	p.3-49
	Zero reset memory [ZER.MEM]	Zero reset memory [ZER.MEM]	Off [OFF] */On [ON]	p.3-41
	Timing/Reset key input [KEY.IN]	Timing/Reset key input [KEY.IN]	Off [OFF] */On [ON]	p.3-34
	Measurement cycle [CYCLE]	Measurement cycle [CYCLE]	Display current measurement cycle 500 to 10000 μs (Default: 500)	p.3-47
	Controller information [C.INFO]	Version [VER]	Display version	p.3-47
		MAC address [MAC.ADR]	Display current MAC address	
	Sensor head information [H.INFO]	Model [MODEL]	Display model	p.3-47
		Serial No. [SER.NO]	Display serial No.	

■RUN mode

Setting [Display]	Option/Setting range [Display]	Pages
Display target task [DISP]	TASK1/TASK2/TASK3/TASK4	p.2-12
HIGH threshold value [H.JUDGE]	Controller: -999.99 to 999.999 Smart Monitor ZW: -999.999999 to 999.999999	p.2-13
LOW threshold value [L.JUDGE]	Controller: -999.99 to 999.999 Smart Monitor ZW: -999.999999 to 999.999999	p.2-13
Decimal point digit [DEC.NUM]	0 [0DIG]/1 [1DIG]/2 [2DIG]/3 [3DIG]/4 [4DIG]/5 [5DIG]	p.2-12

Chapter 1
MEASUREMENT SETUP

System Configuration 1-2

Part Names and Functions 1-3

- Sensor Head 1-3
- Calibration ROM 1-3
- Controller 1-4

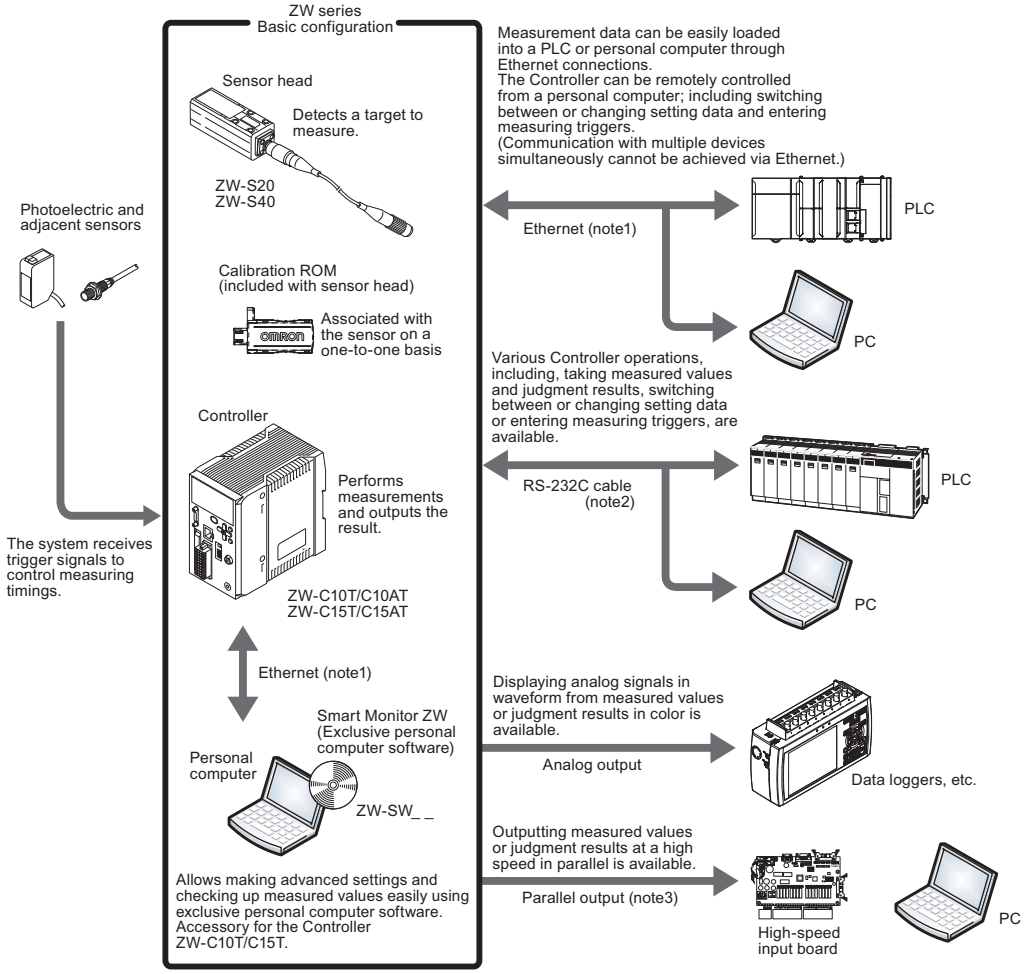
About Installation and Connection 1-7

- Installation of Sensor Head 1-7
- Installation of Controller 1-10
- Connecting Calibration ROM 1-14
- Connecting Fiber Cable 1-15
- Calibrating Sensor Head 1-19

Smart Monitor ZW 1-21

- Operating Environment 1-22
- Installation/Uninstallation Method 1-23
- Settings when Connecting Personal Computer with Controller 1-25
- Starting and Exiting 1-29

In addition to operations with the basic configuration, ZW series displacement sensors can support various measurement applications when combined with numerous peripheral devices.

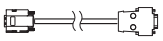


- (Note1) Ethernet cable (sold separately)

Prepare commercially available Ethernet cable satisfying the following requirements:
- Category 5e or more, 30 m or less
- RJ45 connector (8-pin modular jack)
- For direct connection: Select cross cable.
- For connection through a network hub: Select straight cable.

- (Note2) RS-232C cable (optional)

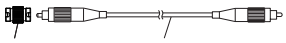
Depending on connecting devices, exclusive cables may be supplied.



For PLC/programmable terminal: ZW-XPT2
For personal computer: ZW-XRS2

- Extension fiber cable (optional)

A exclusive extension fiber cable is available to place the Sensor Head and Controller far apart than the normal distance to each other.
Use the exclusive product for correct measurements.

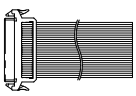


Connecting adapter (included with the fiber cable for extension)
ZW-XFC

Extension fiber cable
ZW-XF_ _R
(2 m/5 m/10 m/20 m/30 m)

- (Note3) Parallel cable (optional)

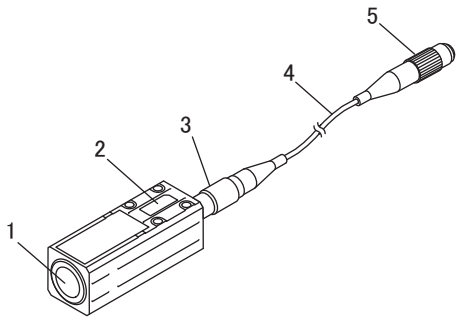
A parallel cable for 52-pole extension connector (ZW-XCP2) with 2 m cable is available.



Part Names and Functions

The following describes the names and functions of parts of the Sensor Head, Calibration ROM and Controller.

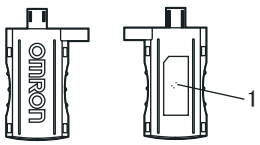
Sensor Head



No.	Names	Functions
1	Projector/receiver	Projects and receives light.
2	Serial number	Serial number. Only a calibration ROM with the same serial number is available.
3	Fiber interface	Interfaces the Sensor Head and optical fiber (unremovable).
4	Fiber Cable	Sends or receives light signals to/from the Controller.
5	Fiber Connector	Couples the Controller and fiber cable.

Calibration ROM

This ROM is associated with the sensor on a one-to-one basis, and operates connected to the Controller.



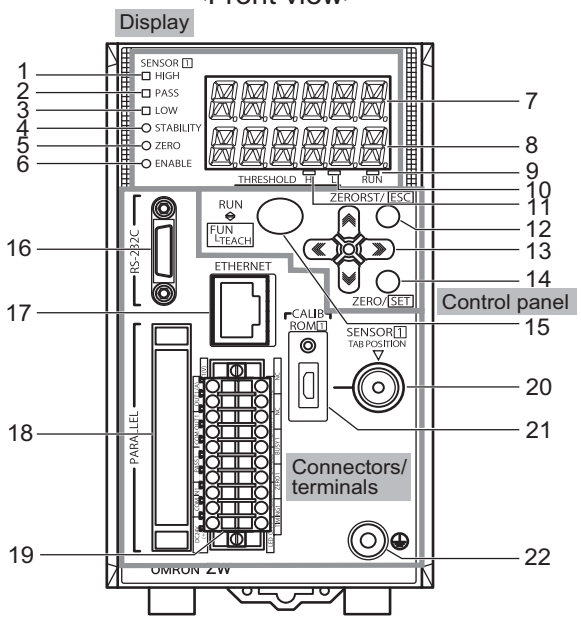
No.	Names	Functions
1	Serial number	Serial number. Only a Sensor Head with the same serial number is available.

CHECK!

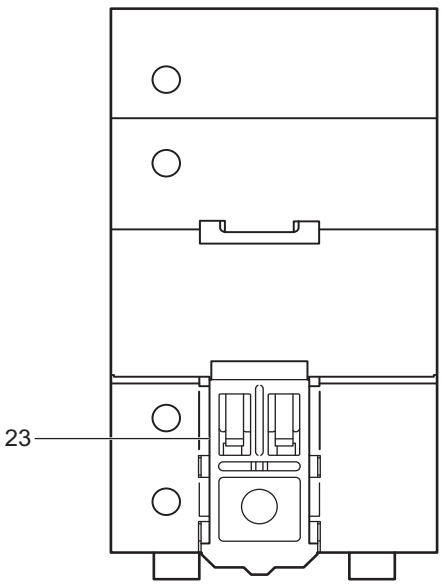
Use with the Calibration ROM always connected. If the Calibration ROM is not connected, an error is displayed.

Controller

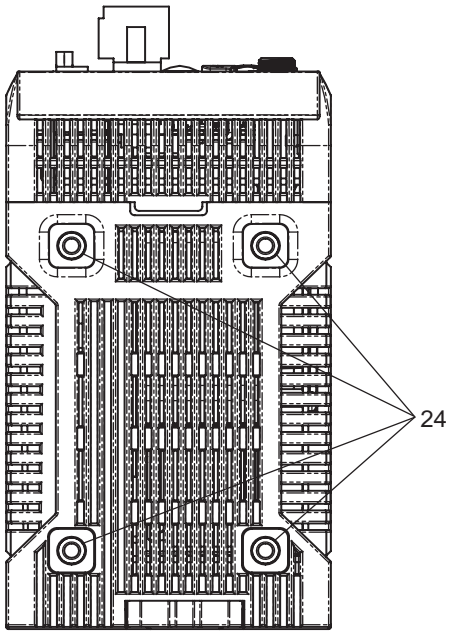
<Front view>



<Rear view>



<Bottom view>



■ Front view

● Display

No.	Names (light color)	Functions
1	HIGH indicator (orange)	The HIGH indicator is lit while judgment is resulted in HIGH (HIGH threshold value < measured value).
2	PASS indicator (green)	The PASS indicator is lit while judgment is resulted in PASS (LOW threshold value ≤ measured value ≤ HIGH threshold value).
3	LOW indicator (orange)	The LOW indicator is lit while judgment is resulted in LOW (measured value < LOW threshold value).
4	STABILITY indicator (green)	The STABILITY indicator is lit while a measured value is within the measuring range. It goes out if a measured value is out of the measuring range.
5	ZERO indicator (green)	The Zero Reset indicator is lit while the zero reset function is enabled.
6	ENABLE indicator (green)	The ENABLE indicator lights when the Sensor is ready for measurement. It goes off when measurement is not possible (e.g. when the received light amount is excessive or insufficient, when the measuring range is exceeded, when the calibration ROM is not connected, or when measurement is not being performed in FUN mode).
7	Main display (red)	The main display shows measured values and/or function names.
8	Sub-display (green)	The sub-display shows additional information for measured values or setting values for functions.
9	RUN indicator (green)	The RUN indicator is lit in the RUN mode, and goes out in the FUN mode.
10	THRESHOLD-L indicator (orange)	The LOW threshold value indicator is lit when the Sub-display indicates a LOW threshold value.
11	THRESHOLD-H indicator (orange)	The HIGH threshold value indicator is lit when the Sub-display indicates a HIGH threshold value.

● Control panel

No.	Names	Functions
12	ZERORST/ESC key	These keys function differently depending on operation modes. Functions of Operating Keys p.2-3
13	← (LEFT) key → (RIGHT) key ↑ (UP) key ↓ (DOWN) key	
14	ZERO/SET key	
15	Mode switching key	

● Connectors/terminals

No.	Names	Functions
16	RS-232C connector	Connect the RS-232C cable when you are connecting the system with a PLC or personal computer through RS-232C. For the RS-232C cable, please use the following exclusive products: If you use a cable not included in the exclusive products, a false operation or breakdown may result. • For connecting to a PLC or programmable terminal: ZW-XPT2 • For connecting to a PC: ZW-XRS2
17	Ethernet connector	This connector is used to connect with a personal computer through Ethernet. Prepare commercially available Ethernet cable satisfying the following requirements: • Category 5e or more, 30 m or less • RJ45 connector (8-pin modular jack) • For one-to-one connection: Select cross cable. • For connection through a network hub: Select straight cable.
18	52-pole expansion connector	The 52-pole expansion connector is used to utilize extended functions, such as binary I/Os, including output for measured value, GATE signal or binary output task number outputs, or binary output object task selection input signals; or bank I/O, including bank number output or bank select input . A parallel cable for 52-pole extension connector (ZW-XCP2) with 2 m cable is available.
19	20-pole terminal block	The 20-pole terminal block connects the Controller DC24 V power supply and basic I/Os, including output for analog voltage, analog current, judgment, ALARM, BUSY or ENABLE, or input for ZERO, RESET, TIMING or LED-OFF.
20	Fiber connector	The fiber connector connects the fiber cable.
21	ROM connector	The ROM connector connects the calibration ROM.
22	Frame ground terminal	This is the connector for frame ground. It connects grounding wire.

■ Rear view

No.	Names	Functions
23	DIN track attachment hook	Used when fixing the controller on DIN track.

■ Bottom view

No.	Names	Functions
24	Installation hole	Used when fixing the controller with screws.

About Installation and Connection

■ Checking the installation environment

Read “Precautions for safe use” at the beginning of this manual, and check the installation environment.

Precautions for safe use p.6

■ Checking the installation site

Read “Precautions for correct use” at the beginning of this manual, and check the installation site.

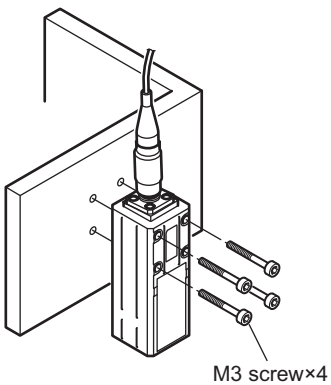
Precautions for correct use p.8

Installation of Sensor Head

■ Installation procedure

Place the Sensor Head with an appropriate distance from the target to measure, fixing it by tightening four M3 screw inserted into their respective installation holes.

Tightening torque: 0.54 N・m



CHECK!

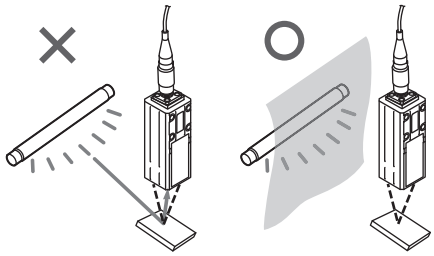
- For the location screw holes, see the external dimensions.

External Dimensions p.6-3

- When measuring on a high-reflectivity workpiece, such as a mirror or wafer, false measured values beyond the measuring range may be outputted. When a workpiece with diffuse reflection is used, we recommend installing and adjusting while watching the position of the spot.

● **Basic precautions for installation**

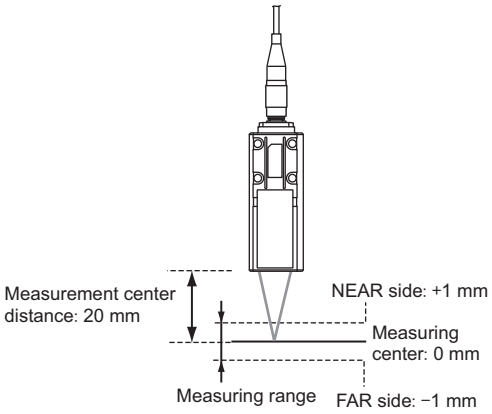
Do not install the Sensor Head in a place where strong light hits the laser emitter/ receiver section of the Sensor Head. Also, if a workpiece has a shiny surface, the light from the lighting will be reflected and a malfunction may occur. In such a case, prevent reflection by, for example, covering the light to stop reflection.



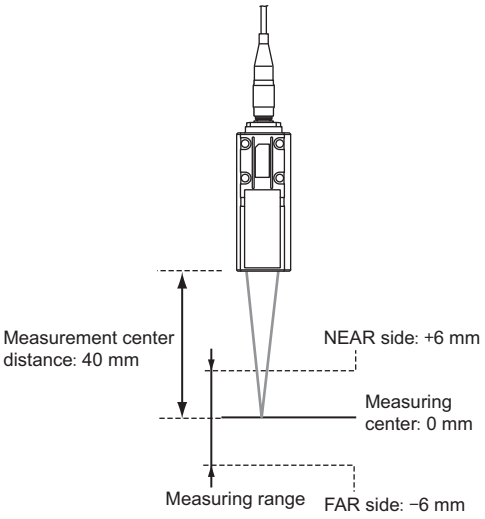
■ Measuring range

With the ZW series, the measurement center distance is expressed as 0 with the NEAR side as + and the FAR side as -.

●ZW-S20



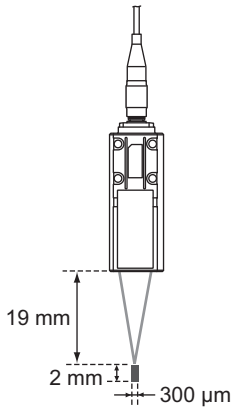
●ZW-S40



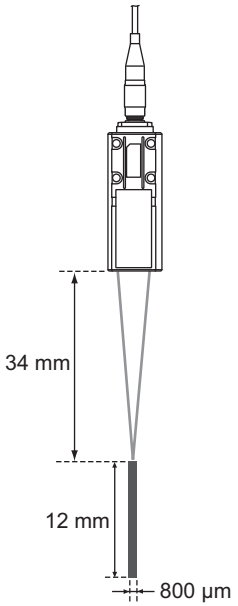
■ Mutual interference

When using two or more Sensor Heads next to each other, mutual interference will not occur if other beam spots are outside the ■ areas in the following diagrams.

●ZW-S20



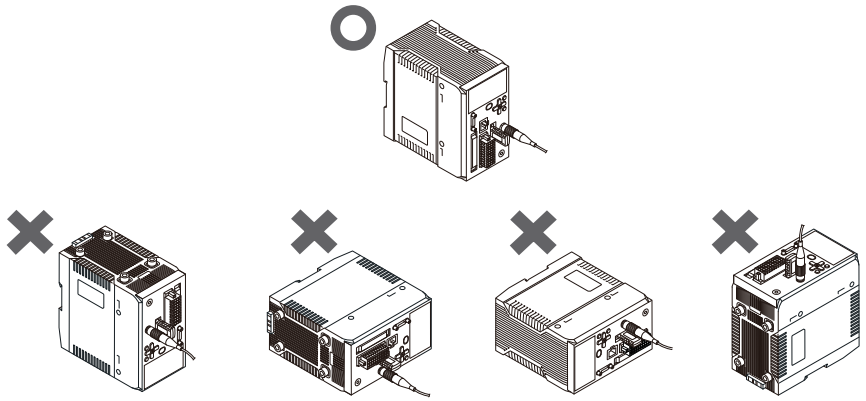
●ZW-S40



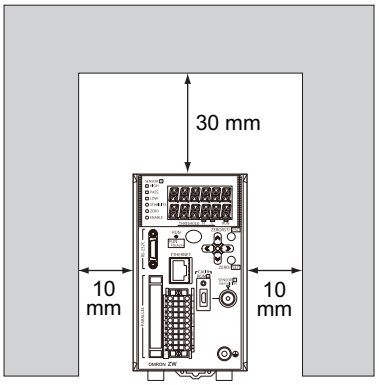
Installation of Controller

■ Precautions for installation

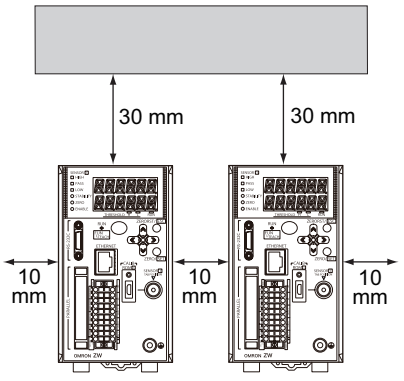
Install the Controller in the orientation indicated by the circle mark in the following figure. Do not install it laying on its side or upside down.



For adequate intake and/or exhaust, keep the Controller clear by 30 mm or more on its top, and by 10 mm or more from either side.
To secure the Sensor Head and cables connected safely, keep the front of the Controller clear by 65 mm or more.



If more than one Controller must be placed in parallel, place them 10 mm or more apart each other, keep them clear by 30 mm or more on their top and 30 mm or more under them.

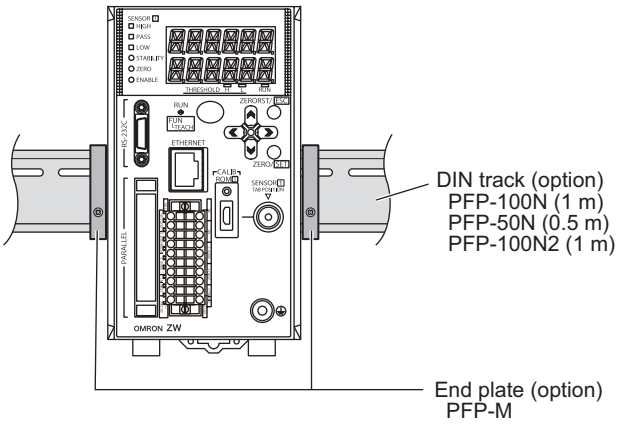


CHECK!

Do everything possible to avoid installation in a location with vibration.

■ Installing on the DIN track

The following describes how to attach the Controller on a 35 mm-wide DIN track.

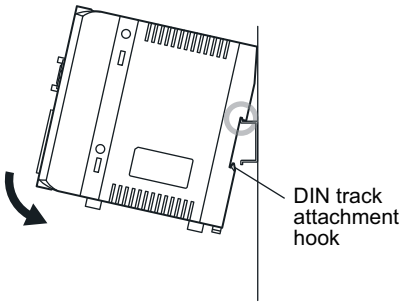


● Installation procedure

1. Hook the upper edge of the Controller's back slot onto the upper edge of the DIN track.

2. Push the Controller down onto the DIN track until the DIN track attachment hook is locked.

Push down until you hear it snap into place.

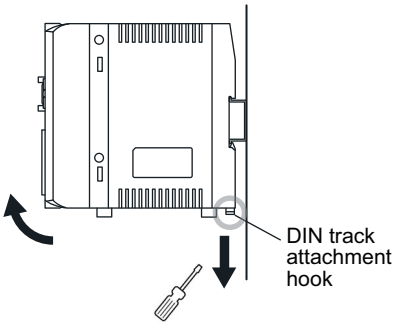


CHECK! Always hook the upper edge of the slot on the Controller's back first onto the DIN track. Hooking the Controller starting from the lower edge of the slot may impair the mounting strength. After completely installing the Controller, make sure that it is securely fixed.

● Removal procedure

1. Pull DIN track attachment hook downwards using a slotted screwdriver or an equivalent.

2. Lift up the Controller from the lower side, and remove it from the DIN track.



■ Installing on bottom

The following describes how to attach the Controller on its bottom.

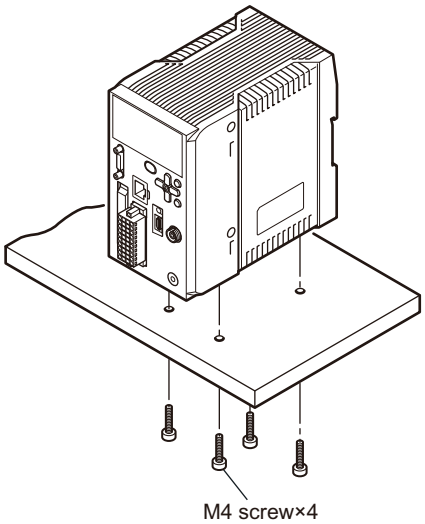
1. Drill four installation holes on the base.

CHECK! For the location installation holes, see the external dimensions.

External Dimensions p.6-11

2. Tighten four M4 screws to fix the Controller on the base.

Tightening torque: 1.2 N・m
Controller thread depth: 6 mm

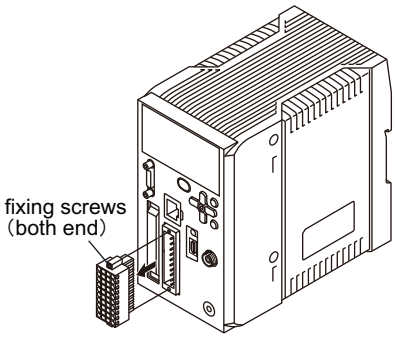


■ Connecting to 20-pole terminal block

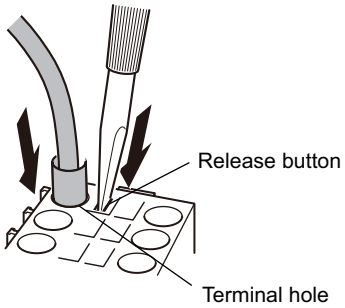
To connect the Controller power supply and signal line to the 20-pole terminal block, follow the steps below:

20-pole terminal block p.4-2

1. Loosen the two fixing screws using a screwdriver to remove 20-pole terminal block from the Controller.



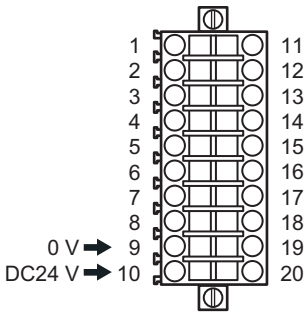
2. Push in and hold the release button next to the terminal hole using a screwdriver while pushing the wire fully into the terminal hole and remove the screwdriver.
After the connection has been established, pull the wire gently, to make sure that the connection has been made securely.



3. Reinstall the 20-pole terminal block to the Controller.

● Connecting Controller power supply

Connects 24 VDC power supply to terminals 9 and 10 on the 20-pole terminal block.



CHECK!

When connecting the power supply, be sure to adhere to the following requirements:

- For the power supply, use AWG18 to 28 cables.
- Make the cable tip exposed by approx. 7 mm.

The following product is recommended for the 24 VDC power supply:

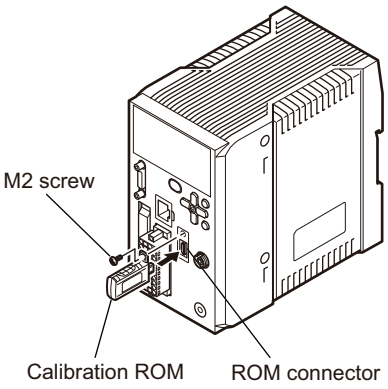
S8VS-06024 (Omron, 2.5 A, 60 W)

Connecting Calibration ROM

To connect the calibration ROM to the Controller, follow the steps below:

1. **Connect the calibration ROM to the ROM connector on the Controller.**

2. **Fix the calibration ROM by tightening the supplied M2 screw.**
   Tightening torque: 0.15 N・m max.



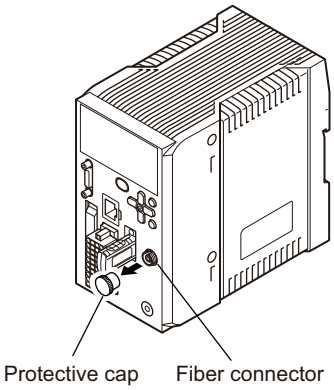
CHECK!

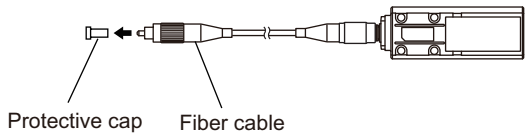
- Before connecting or disconnecting the calibration ROM, make sure that the Controller's power supply is turned OFF. The Controller may break down if the calibration ROM is connected while the power is ON.
- Use with the Calibration ROM always connected. If the Calibration ROM is not connected, an error is displayed.
- Only a calibration ROM and Sensor Head with a same serial number are compatible. When connecting a calibration ROM with a Sensor Head, make sure that they have a same serial number, or measurement cannot be performed correctly.

Connecting Fiber Cable

Connect the fiber cable on the Sensor Head to the Sensor Head connector on the Controller as follows:

1. Remove the protective caps from the controller's fiber connector and the fiber cable.

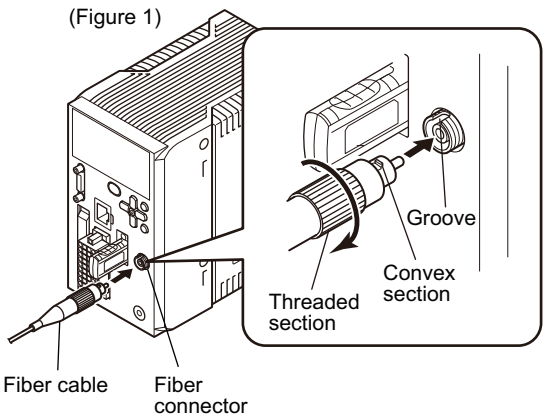




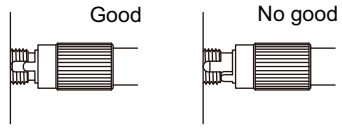
CHECK! Do not discard but keep the protective cap handy.

2. Mate the convex section on the fiber cable with the groove on the fiber connector and turn the threaded section clockwise while pushing in (see figure 1).

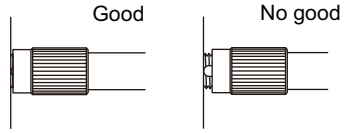
(Figure 1)



(Figure 2)



(Figure 3)



In the "No good" status in figure 2 and figure 3, optic signals cannot be transmitted and correct measurement is not possible. Always check that the system is in the "Good" status.

- Handling fiber cables
  Use them in compliance with the following.
  -Fiber cable bend radiuses must be at least 20 mm.
  -Do not let bending cause stress at the root section of a fiber connector.
  -Do not yank hard on a fiber cable.
  -Do not step on a fiber cable or place anything heavy on it.
- Do not touch the end surface of a fiber cable, or the cable may be degraded in performance. Should the end surface be touched or soiled, wipe the dirt away using a commercially available cleaner exclusive for fiber connectors or dry and soft cloth. Do not use a cloth moistened with alcohol, or the dirt may be reattached.

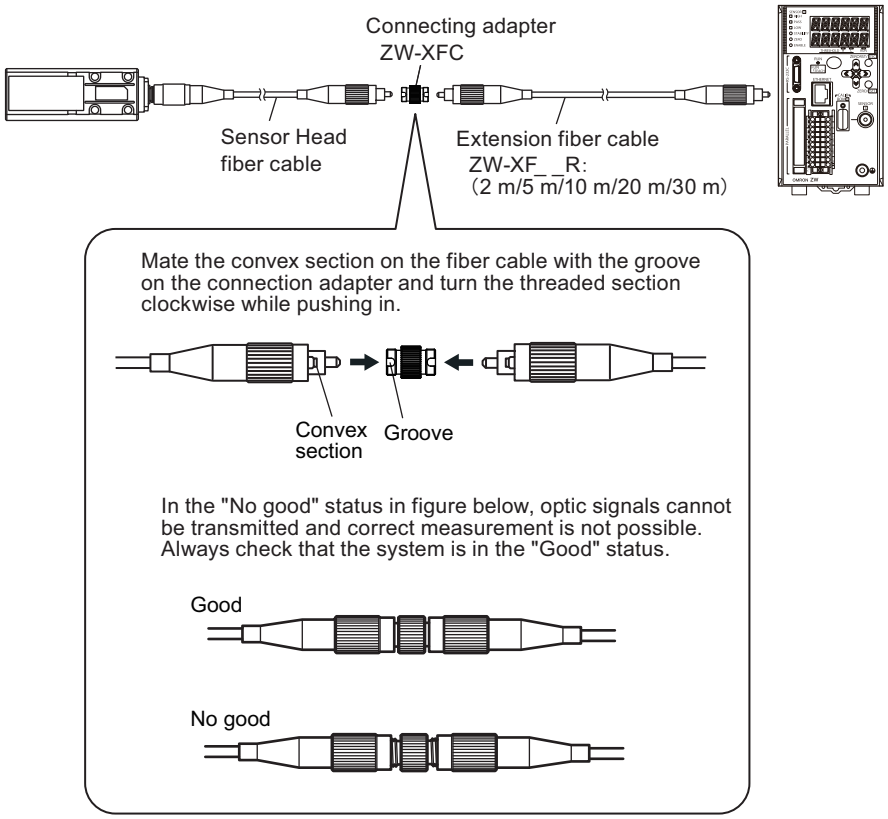
Point	Item	Model	Manufacturer
Sensor Head side Fiber connector	OPTIPOP R1	ATC-RE-01	NTT Advanced Technology Corporation
Controller side Fiber connector	NEOCLEAN S250	ATC-ST-02N	

- The fiber cable and fiber connectors should not be left with their protective caps removed, not even for a short period of time. Leaving them unprotected can let dirt get on the end surface and cause performance deterioration.
- Calibrate the Sensor Head after removing and inserting a fiber cable.

Calibrating Sensor Head p.1-19

■ Extending fiber cable

To extend the fiber cable on the Sensor Head, use an extension fiber cable and connecting adapter.



Extension fiber cable (option)

Model	Length
ZW-XF02R	2 m
ZW-XF05R	5 m
ZW-XF10R	10 m
ZW-XF20R	20 m
ZW-XF30R	30 m

Connecting adapter (option)

Model
ZW-XFC

- The connection adapter (ZW-XFC) comes packed together with the extension fiber cable (ZW-XF_ _R).
- Never use any extension fiber cable and/or connecting adapter other than those specified in the above.
- Hold the combined length of the normal and extension fiber cables to no more than 32 m.
- Only one fiber cable is allowed to extend the normal fiber cable. Never use two or more extension fiber cable connected together.
- Do not touch the end surface of a fiber cable, or the cable may be degraded in performance. Should the end surface be touched or soiled, wipe the dirt away using a commercially available cleaner exclusive for fiber connectors or dry and soft cloth. Do not use a cloth moistened with alcohol, or the dirt may be reattached.

Point	Item	Model	Manufacturer
Sensor Head side Fiber connector	OPTIPOP R1	ATC-RE-01	NTT Advanced Technology Corporation
Controller side Fiber connector	NEOCLEAN S250	ATC-ST-02N	

- The fiber cable and fiber connectors should not be left with their protective caps removed, not even for a short period of time. Leaving them unprotected can let dirt get on the end surface and cause performance deterioration.
- Calibrate the Sensor Head after removing and inserting an optical fiber.

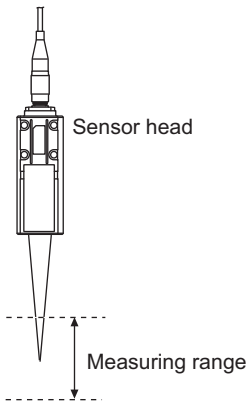
Calibrating Sensor Head p.1-19

Calibrating Sensor Head

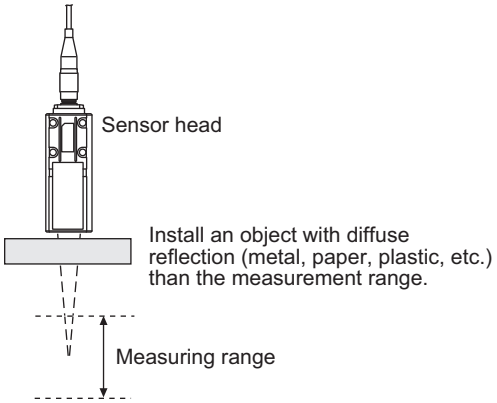
Calibrate the Sensor Head by obtaining the dark data in the no-incoming light status.
- When using the sensor for the first time.
- When removing and inserting a fiber cable from/to the Controller.
- When extending a fiber cable.

The Sensor Head should be calibrated without any workpiece within the measuring range or with the tip of the Sensor Head shielded from light with an object with diffuse reflection. (Correct calibration is not possible with a transparent object, semi-transparent object, or mirror.)

・Without any workpiece within the measuring range



・With light shielded



Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode. (For details on the functions of the RUN/FUN/TEACH key, see p.2-3.)
2	ZERORST/ESC, ZERO/SET	SYSTEM	Press ≪ or ≫ keys to select either of "SYSTEM" and press ZERO/SET key.
3		H.CALIb	Press ≪ or ≫ keys to select either of "H.CALIB" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	H.CALIb OK/CAN	"OK/CAN" appears on the sub-display. To execute press ZERO/SET key, or the ZERORST/ESC key to cancel.

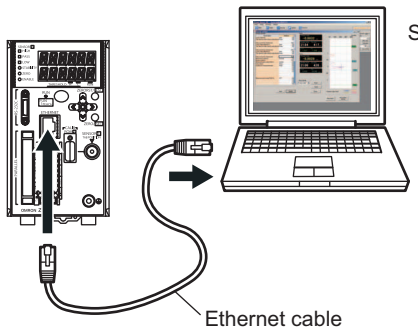
Steps	Key operation	Display	Description
5	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

CHECK!

When Sensor Head calibration fails

If the Sensor Head is calibrated in an inappropriate environment, an error is displayed on the main display. If this happens, press ZERORST/ESC key to return to the previous screen and try again. If an error continues even after calibrating the Sensor Head in an appropriate environment, the fiber connector on the Sensor Head or controller may be stained. Clean the fiber cable referring to p.1-16.

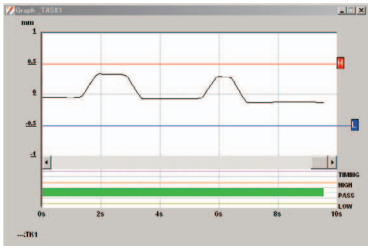
ZW series is provided with the Smart Monitor ZW software utility. This utility allows you to set up sensing functions and monitor the waveforms of measurement results on a personal computer.



● Monitoring the measurement state

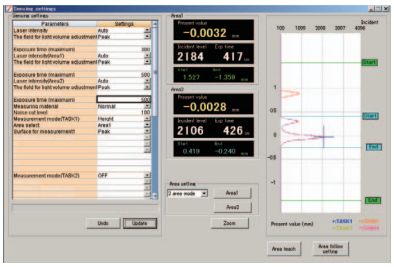
Checks the measured value of the gang-mounted controller in the list.

Displays the change of the time series for the measured value in a graph.

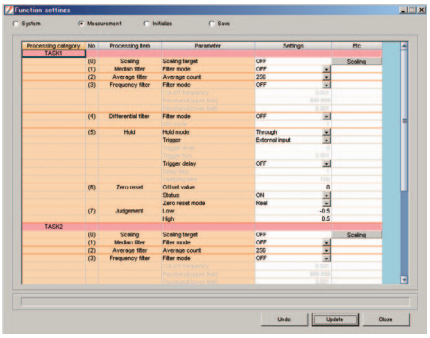


● Setting support for functions

Sets the sensing conditions in detail while checking the receiving status of the Sensor Head (sensitivity).



Displays and sets the settings for the controller in the list.



Operating Environment

The following describes the operating environment for Smart Monitor ZW.
Before starting installation on a personal computer, make sure that it satisfies the following requirements:

Item	Condition
OS	Windows 7 (32 or 64-bit version) Windows XP (Service Pack3 or more, 32-bit version)
CPU	Intel Pentium III, 850 MHz or more (2 GHz or more is recommended.)
Memory	1 GB or more
Free hard disk space	50 MB or more
Display	1024 x 768 dots or more, 16 million colors or more
Supported languages	Japanese/English
Communication port	Ethernet port

• Windows is a trademark or registered trademark of Microsoft Corporation.
• The system and product names are trademarks or registered trademarks of their respective companies.

Installation/Uninstallation Method

The following describes the preparations for using Smart Monitor ZW.

■ Installing Smart Monitor ZW

- Before you install Smart Monitor ZW, quit all other programs that are running. If virus detection software is enabled, installation may take time to complete.
- Log on as an Administrator or a user with system access rights.

1. Turn your PC ON and startup up Windows.

2. Insert your "Smart Monitor ZW" CD-ROM into the CD-DOM drive on your personal computer.

3. Auto-run automatically displays the installation screen. Follow the on-screen instructions to install Smart Monitor ZW.

■ Uninstalling Smart Monitor ZW

- Before you uninstall Smart Monitor ZW, quit all other programs that are running. If virus detection software is enabled, uninstallation may take time to complete.
- Log on as an Administrator or a user with system access rights.

● For Windows 7

1. Turn your PC ON and startup up Windows.

2. Select [Control Panel] from the start menu.

3. Double-click [Uninstall a program].

4. Right-click [SmartMonitorZW] from the list and select [Uninstall].

5. Click the [Yes].

● **For Windows XP**

1. **Turn your PC ON and startup up Windows.**
2. **Select [Control Panel] from the start menu.**
3. **Double-click [Add/Remove Programs].**
4. **Select [SmartMonitorZW] from the list and click the [Remove].**
5. **Click the [Yes].**

Settings when Connecting Personal Computer with Controller

To connect a personal computer with the Controller directly through an Ethernet cable, set up the network on the personal computer as follows:

CHECK!

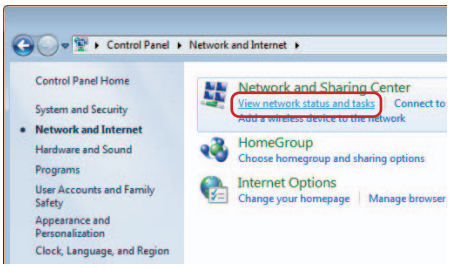
Specify a network address appropriate for the Controller settings as the IP address for the personal computer.

The controller default settings are as follows:
• IP address: 192 168.250.50
• Subnet mask: 255.255.255.0

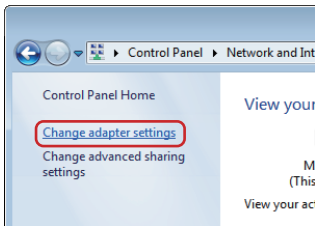
● For Windows 7

1. Select [Control Panel] from the start menu.
The [Control Panel] dialog box appears.

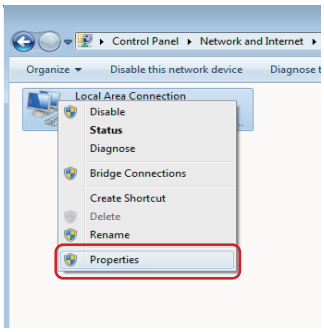
2. Click [Network and Internet], and [View network status and tasks].



3. Click [Change adapter settings].

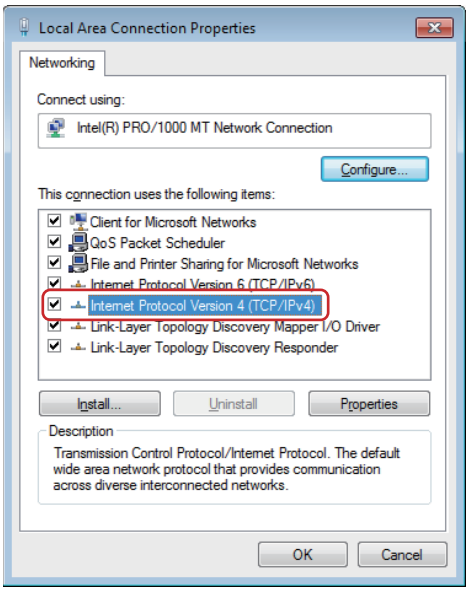


4. Right-click [Local Area Connection] and select [Properties] from the displayed menu.
The [Local Area Connection Properties] dialog box appears.



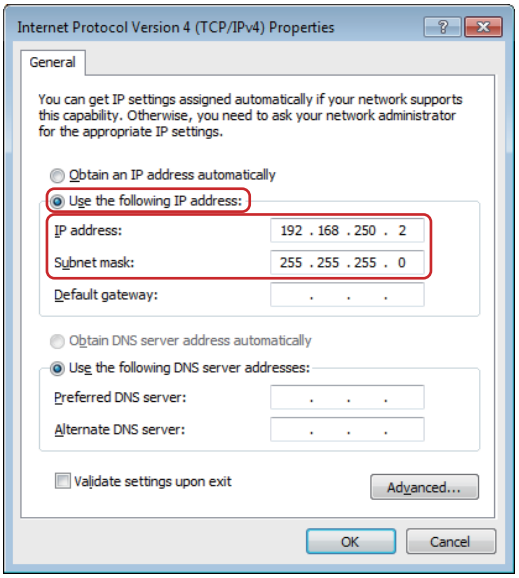
5. **Under the [Network] tab, double-click [Internet Protocol Version 4 (TCP/IPv4)].**

The [Internet Protocol Version 4 (TCP/IPv4) Properties] dialog box appears.



6. **Click the [Use the following IP address] option and enter an IP address and subnet mask.**

Example:
When matching the computer settings to the controller's network address and setting the following values:
IP address: 192.168.250.2
Subnet mask: 255.255.255.0



7. **Click [OK] to complete the configuration.**

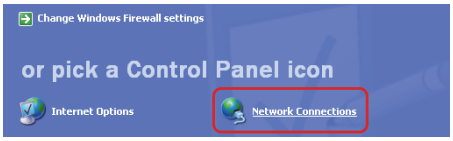
● **For Windows XP**

1. **Select [Control Panel] from the start menu.**

The [Control Panel] dialog box appears.

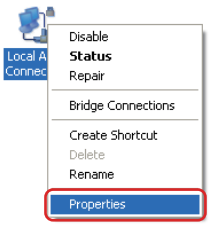
2. **Click [Network and Internet Connection], and [Network Connections].**

The [Network Connections] dialog box appears.



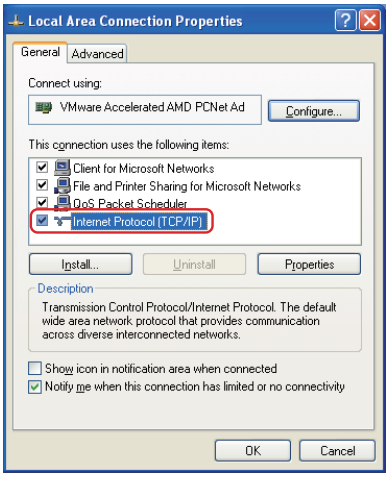
3. **Right-click [Local Area Connection] and select [Properties] from the displayed menu.**

The [Local Area Connection Properties] dialog box appears.



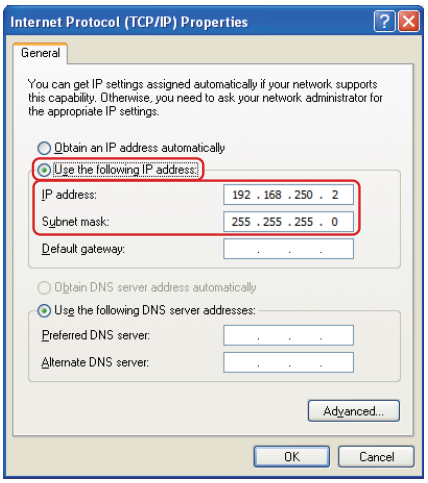
4. **Under the [General] tab, double-click [Internet Protocol (TCP/IP)].**

The [Internet Protocol (TCP/IP) Properties] dialog box appears.



5. **Click the [Use the following IP address] option and enter an IP address and subnet mask.**

Example:
When matching the computer settings to the controller's network address and setting the following values:
IP address: 192.168.250.2
Subnet mask: 255.255.255.0



6. **Click [OK] to complete the configuration.**

Starting and Exiting

■ Start-up of Smart Monitor ZW

After installation is completed, start up Smart Monitor ZW by the following procedure.

1. **Make sure that the Controller is connected to the personal computer.**
2. **Turn the Controller ON and set it to the RUN mode.**
3. **Select [Programs]-[OMRON]-[ZW]-[SmartMonitorZW] from the Windows [Start] menu.**

■ Exiting Smart Monitor ZW

1. **Select [File]-[Close] in the Smart Monitor ZW menu bar.**

Chapter 2
BASIC OPERATION

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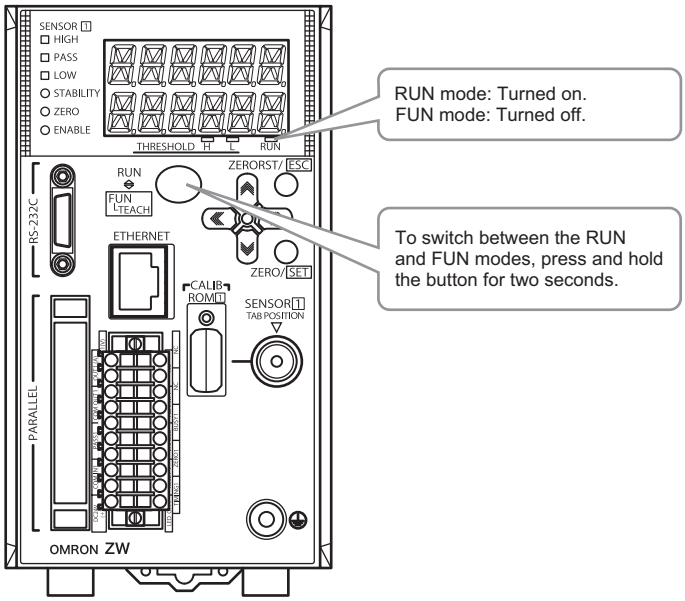
Overview of Setting and Measurement

Operation Modes

The controller has the following three operating modes.
Switch to the desired mode before you start operation.
(The controller starts up in the RUN mode whenever turning it on.)

Mode	Description
RUN Mode	Normal operating mode.
FUN Mode	Mode for setting the measurement conditions.

Use RUN/FUN/TEACH key to switch between the operating modes.
The RUN indicator identifies the current operating mode.



Functions of Operating Keys

The following table lists the names and functions of the operating keys on the controller:

Name		Functions	
		RUN mode	FUN mode
← (LEFT) key → (RIGHT) key		Changes sub-display content.	Functions differently depending on the settings. - Toggles functional displays. - Selects a digit for values. - Cancels settings.
↑ (UP) key ↓ (DOWN) key		key: Executes trigger input. key: Executes reset input. * These keys are only available if key inputs for the hold functions have been enabled in the FUN mode. (See Page p.3-34).	Functions differently depending on the settings. - Switches between selecting menus. - Selects setting values.
Mode switching key		Hold down for at least two seconds to enter the FUN mode.	Hold down for at least two seconds to enter the RUN mode. - For operating mode switching, "SWITCH" is displayed on the main display and "OK/CAN" is displayed on the sub-display. Press the ZERO/SET key to switch the mode. - When the mode is switched from FUN mode to RUN mode, "SAVE" is displayed on the main display and "OK/CAN" is displayed on the sub-display. Press the ZERO/SET key to save the settings and switch the operating mode. Press the ZERORST/ESC key to switch the operating mode without saving the settings. If you press for less than 2 seconds, the display shifts to RUN mode task switching and the threshold value setting menu. Also, this starts teaching to set threshold values when setting a threshold value.
ZERO/SET key		Executes a zero reset.	Functions differently depending on the selections. - Applies the selected conditions or values. - Switches to a lower menu.
ZERORST/ESC key		Hold down for at least two seconds to cancel a zero reset.	Functions differently depending on the selections. - Cancels a selected condition or value. - Switches to an upper menu. Hold down for at least two seconds to jump to the top menu on the FUN mode.

Digital Displays

The theme displayed on the main or sub-display varies depending on the currently selected operating mode.
The following table lists the theme displayed, when turning the controller on, or in the RUN or FUN mode.

Operating mode	Main display (upper line, in red)	Sub-display (lower line, in green)
When turning on	The controller model name, "ZW-C_ _" appears.	During the initialization, "INIT" is displayed.
The system enters the RUN mode after displaying "INIT" for a few seconds.		
RUN mode	The task measurement result appears. The task to display can be toggled (see p.2-12).	Press ◀◀ / ▶▶ key to cycle through the sequence of the HIGH and LOW threshold values, analog output (voltage/current), judgment result, resolution (the max. and min. values for one-min measured value), exposure time, distance (sensor to the object to measure), effective bank and displayed task in descending or ascending order.
Press and hold RUN/FUN/TEACH ○ key for two seconds or more to switch between the RUN and FUN modes.		
FUN mode	Press ◀◀ / ▶▶ keys to cycle through the function names in descending or ascending order.	When reaching the lowest layer, the setting value displayed on the main display appears.

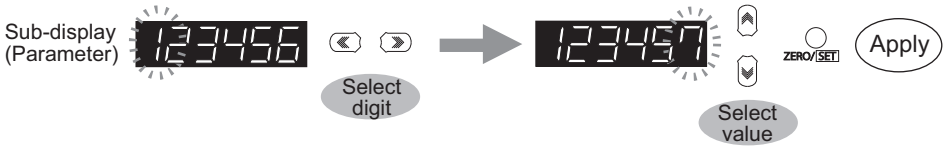
■ Alphabetical notation

Alphabets are displayed on the main and sub-display as follows:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

■ Entering numerical values

To enter numerical values, including parameters, for the sub-display, follow the steps below:



(1) When entering numerical values, the sub-display displays the current setting value and its uppermost digit flashes.

(2) Press the ◁ / ▷ keys to select a digit to enter a number.

Press the ▷ key on the rightmost digit moves blinking to the leftmost digit.

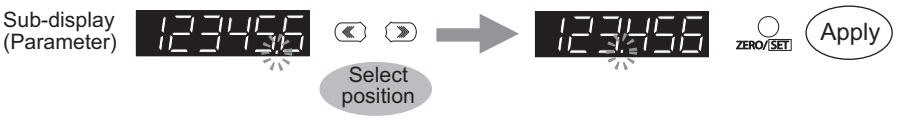
Press the ◁ key on the leftmost digit moves blinking to the rightmost digit.

(3) Press the △ / ▽ keys to select a number to enter.

(4) Press the ZERO/SET key to apply the entered value.

● Positioning decimal point

To position a decimal point, follow the steps below:



(1) If a decimal point has been defined, it flashes on the sub-display.

(2) Press the ◁ / ▷ keys to position the decimal point.

Position the decimal point at the rightmost digit to erase it.

Press the ▷ key on the rightmost digit moves blinking to the leftmost digit.

Press the ◁ key on the leftmost digit moves blinking to the rightmost digit.

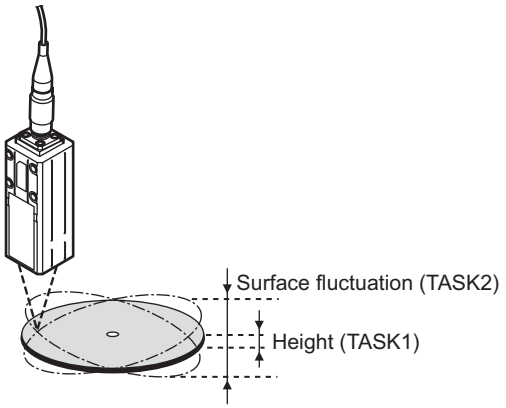
(3) Press the ZERO/SET key to apply the position of the decimal point.

Multi-task and Bank Data

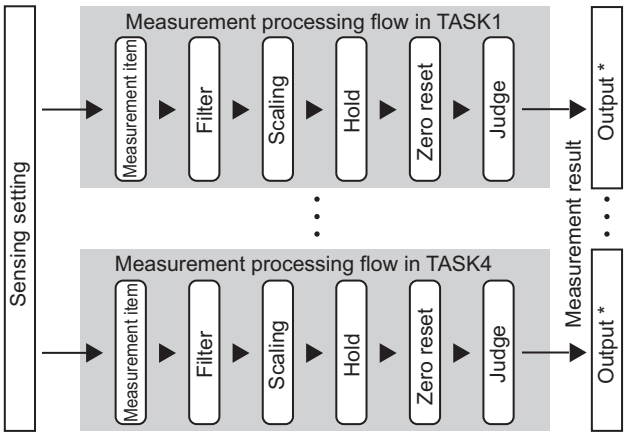
■ Multi-task function

In the ZW Series, you can set multiple measurement processing for one sensing setting. This measurement processing is called a "task (TASK)."

Example: Measure the height and surface fluctuation simultaneously



For tasks, "TASK1" to "TASK4" are available for registration.
You can measure and judge up to four characteristic points simultaneously because you can measure the desired measurement items such as peak, bottom, and average for each task.



* For the output, the following four types are supported:

−Analog output
Select one TASK that you want to output.

−Judgment output
Select one TASK that you want to output.

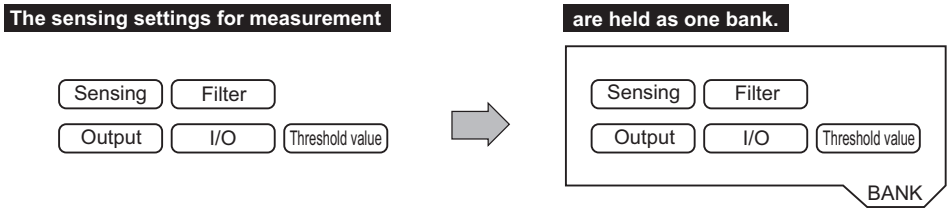
−Binary output
Can output data from four tasks at a time.

−Serial output (Ethernet/RS-232C)
Can output data from four tasks at a time.

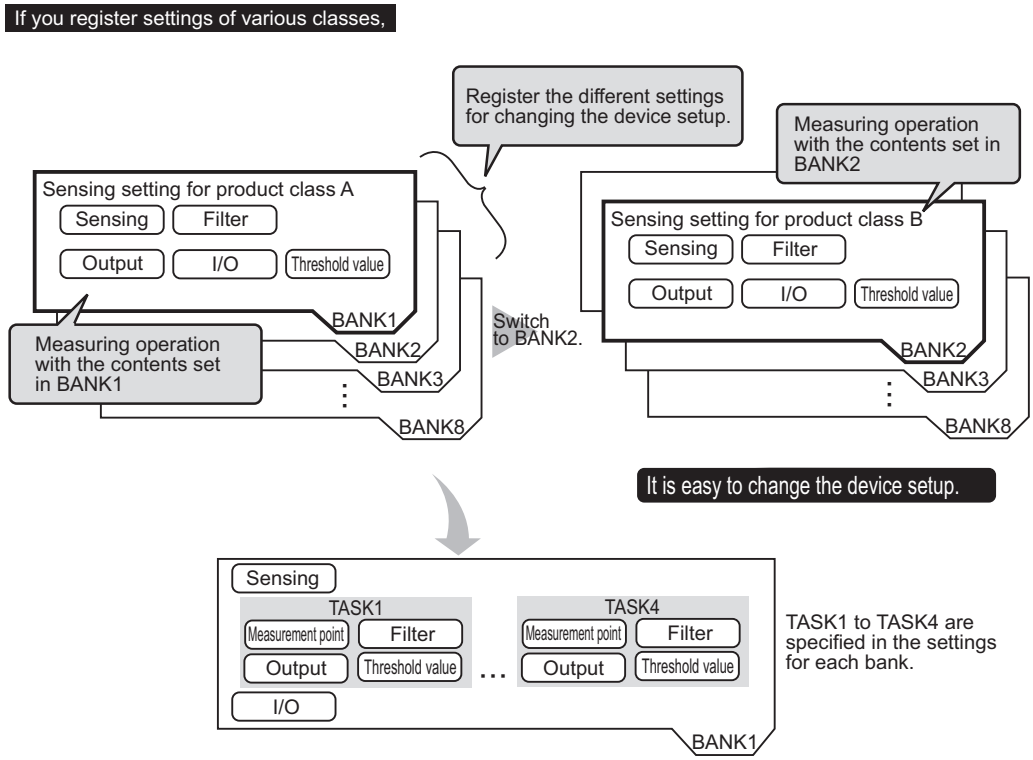
■ Bank data

ZW series can hold up to eight sets of settings, which are called a "bank (BANK)". When the device setup is changed, you can switch the bank externally.

● What is bank?



● Example of bank switching for settings



CHECK!

- If only the "threshold value" is different in the settings for a bank, by changing the mode of the bank, you can increase the number of banks from 4 to 32.

Changing the Bank Mode p.3-43

- The output destination (current output value/voltage output value) in the I/O setting parameters is set the same for all banks. The output destination cannot be set separately for individual banks.

Setting Flow

Preparation for measurement

Installation & Connection
Attach a Sensor Head.
Chapter 1 MEASUREMENT SETUP - About Installation and Connection

Power ON

Default setting when connect sensor head
Calibrate the Sensor Head.
Chapter 1 MEASUREMENT SETUP - Calibrating Sensor Head

Setting measurement items

Setting measurement items
Select task(s) from TASK1 to TASK4, and set up measurement items, including height, thickness and calculation.
Chapter 3 SETTINGS FOR FUNCTIONS - Setting Measurement Items

Setting for output processing

Setting the Scaling
Correct the display of the measured value.
Chapter 3 SETTINGS FOR FUNCTIONS - Setting the Scaling

Setting HOLD
Set the hold conditions.
Chapter 3 SETTINGS FOR FUNCTIONS - Setting the Hold

Setting the Zero Reset
Set zero reset.
Chapter 3 SETTINGS FOR FUNCTIONS - Zero Reset

Saving the Settings

Save the Settings Data
Save the data you have set.
Chapter 3 SETTINGS FOR FUNCTIONS - Saving the Bank/System Settings

CHECK!
Make sure that you always save the data after you set it.
If you turn OFF the power without saving the data, all the settings data will be cleared.

Functions Used During Operation

Threshold Setting	Chapter 2 BASIC OPERATION - Setting Threshold Value
Bank Switching	Chapter 2 BASIC OPERATION - Bank Switching
Executing Zero Reset	Chapter 2 BASIC OPERATION - Zero Reset

Operations and Settings as Required

I/O Setting (Analog, Judgement, and Binary output)	Chapter 4 I/O SETTINGS
Using Ethernet/RS-232C Communications	Chapter 5 Ethernet/RS-232C COMMUNICATION
Setting Banks	Chapter 3 SETTINGS FOR FUNCTIONS - Changing the Bank Mode
Setting the System Environment	Chapter 3 SETTINGS FOR FUNCTIONS - Setting the System

If You Cannot Perform a Measurement Smoothly

Changing Material Settings	Chapter 3 SETTINGS FOR FUNCTIONS - Setting the Material for the Target to Measure
Changing Exposure Time Control Mode Settings	Chapter 3 SETTINGS FOR FUNCTIONS - Setting Exposure Time Control Mode
Setting Filter	Chapter 3 SETTINGS FOR FUNCTIONS - Setting the Filter

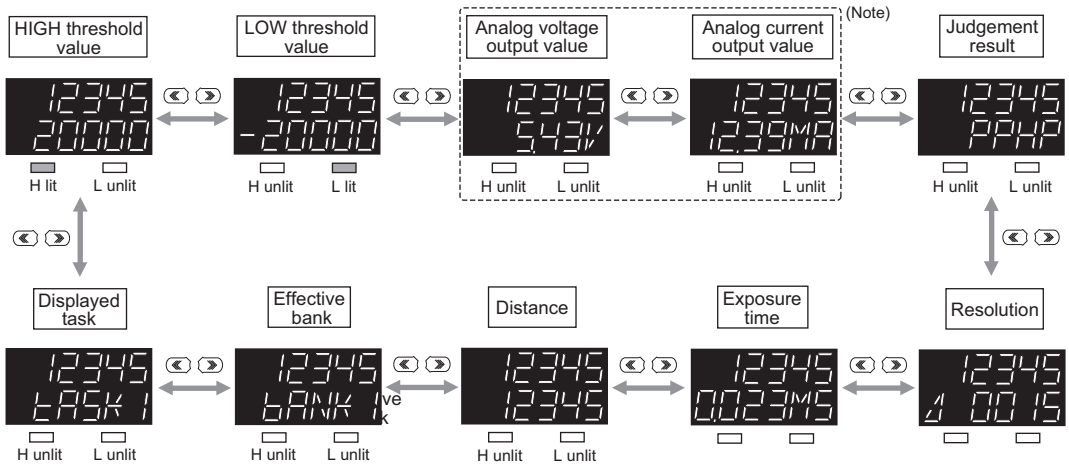
When a problem occurs...

When The Smart Sensor Does Not Operate Correctly	Chapter 7 APPENDIX - Troubleshooting
When An Error Message Appears	Chapter 7 APPENDIX - Error Messages and Countermeasures

Functions and Operations during Measurement

Switching the Display during RUN mode

In RUN mode, you can switch measured value display by pressing the ◀◀ / ▶▶ keys during the operation.
You can check the threshold value and analog output value while displaying the measured value on the main display.



- "Displayed task" can be selected from TASK1 to TASK4.
- The above display screenshots are only samples and may different from actual displays.

(Note)
An output item not selected on the analog output (Voltage output/Current output) is displayed as "------" on the sub-display. For example, if "Voltage output" is selected on the analog output, the analog current output value is displayed as "------" on the sub-display.

■ Details displayed on the main display

The measured values always appear on the main display.
The measured values are initialized as follows:

- Reference value 0: measurement center distance
- + display: NEAR (close range) side
- - display: FAR (far range) side

■ Details displayed on the sub-display

The items listed in the following table appears on the sub-display.

Press the ◀◀ / ▶▶ keys to toggle the display.

Display Details	Description
Threshold	Displays the HIGH and LOW threshold values. When displaying a HIGH threshold value, the THRESHOLD-H indicator lights up, while for a LOW threshold value, the THRESHOLD-L indicator lights up.
Analog output	Displays the voltage or current value output in analog format. The display details for the output destination setting are different for voltage output and for current output. (Values displayed here are reference values only. These values differ from actual analog output values.)
Judgment result	The judgment result for each task appears. The TASK1, 2, 3 and 4 judgment results are displayed starting from the left. H: HIGH P: PASS L: LOW E: ERROR
Resolution	Displays the fluctuation width (peak to peak) of the measured value over a fixed amount of time.
Exposure time	Displays the current exposure time. It ranges from 1 to 5000 μs.
Distance	Displays the distance from the sensor to a target to measure.
Effective bank	Displays the current bank number.
Displayed task	Displays the currently selected task number, from TASK1 to TASK4. The measured value for the selected task appears on the main display.

■ Display details change

The measurement result displayed on the main display in RUN mode can be selected from TASK 1 to 4.

The number of digits displayed can also be changed.

Settings [Display]	Description [Display]
Task for displayed target [DISP]	TASK1/TASK2/TASK3/TASK4
Decimal point digit [DEC.NUM]	0 [0DIG]/1 [1DIG]/2 [2DIG]/3 [3DIG]/4 [4DIG]/5 [5DIG]

As an example, here is an explanation of the procedure for setting TASK2 as the task to be displayed target.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key in the RUN mode to display the setting menu.
2	ZERORST/ESC, ZERO/SET	dI SP	Press ◄ or ► keys to select either of "DISP" and press ZERO/SET key.
3	ZERORST/ESC, ZERO/SET	dI SP TASK2	Select the task to be displayed target. The current setting value is displayed on the sub-display. Press ▲ / ▼ key to enter the editing mode, and the sub-display blinks. Select either of "TASK2" and press ZERO/SET key.
4	ZERORST/ESC	LIT H L RUN	Press ZERORST/ESC key in the RUN mode to exit the setting menu.

■ Threshold values change

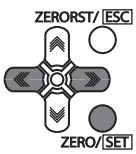
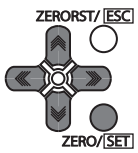
The threshold value for the task displayed on the main display in RUN mode can be changed.

CHECK! To change the target task, change the task displayed on the main display.

Display details change p.2-12

As an example, here is an explanation of the procedure for setting the HIGH threshold value by entering "1.000" directly.

Operating procedure

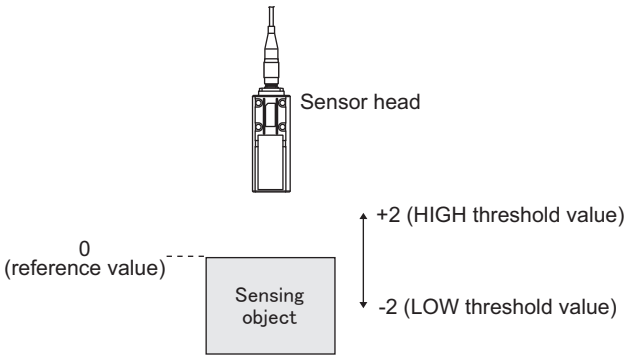
Steps	Key operation	Display	Description
1			Press RUN/FUN/TEACH key in the RUN mode to display the setting menu.
2			Press ◀ or ▶ keys to select either of "H.JUDGE" and press ZERO/SET key.
3			Set "1.000" as the HIGH threshold value. The current measured value is displayed on the main display and the current set threshold value is displayed on the sub-display. (At that time, the THRESHOLD-H indicator lights up.) Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter "1.000" and press ZERO/SET key.
4			Press ZERORST/ESC key in the RUN mode to exit the setting menu.

Zero Reset

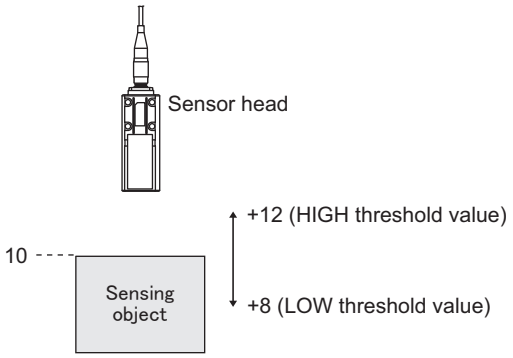
■ What is zero reset?

This function allows resetting the measured value to "0" at any timing during measurement in the RUN mode.
The measured value can be displayed and output as a positive or negative deviation (tolerance) from the set reference value "0".

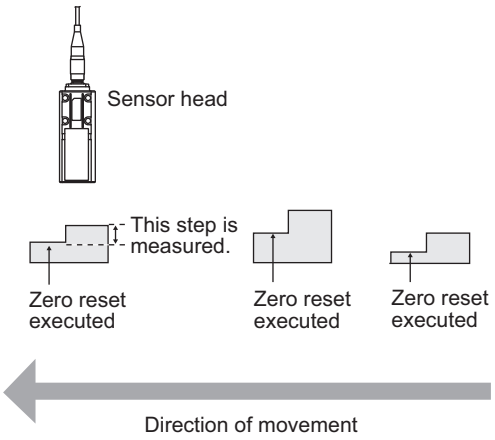
Example 1:Using the height of sensing object registered as the reference value and the tolerance output as the measured value



Example 2:Using the height of sensing object as the measured value with an offset set to 10



Example 3:Using zero reset to measure steps in sensing object (zero reset at each measurement

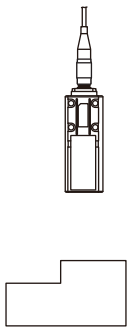


The zero reset function also allows setting the reference value to the hold value for a hold measurement or any value other than zero.

Setting the Zero Reset p.3-37

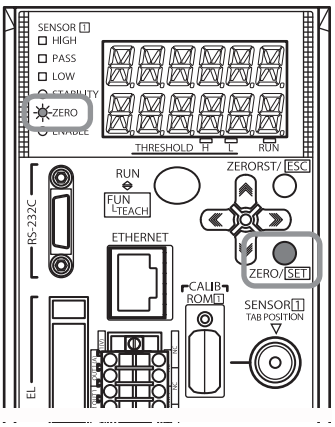
■ Executing zero reset

1. Place the reference sensing object in position.



2. **Press ZERO/SET key.**

The ZERO indicator illuminates and the current measured value is registered as 0 (zero).



CHECK!

- When a zero reset is executed, the analog output becomes the voltage or current value at the center of the two preset points. Analog output becomes roughly 0 V or 12 mA when focus is not set.

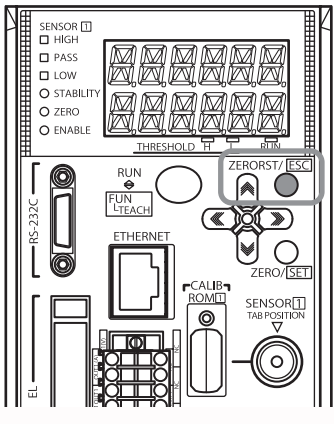
Setting focus p.4-14

- The Zero Reset function can also be executed by supplying a ZERO signal to the 20-pole terminal block.

20-pole terminal block p.4-2
ZERO input p.4-8

■ Canceling zero reset

1. **Press and hold ZERORST/ESC key for two seconds.**



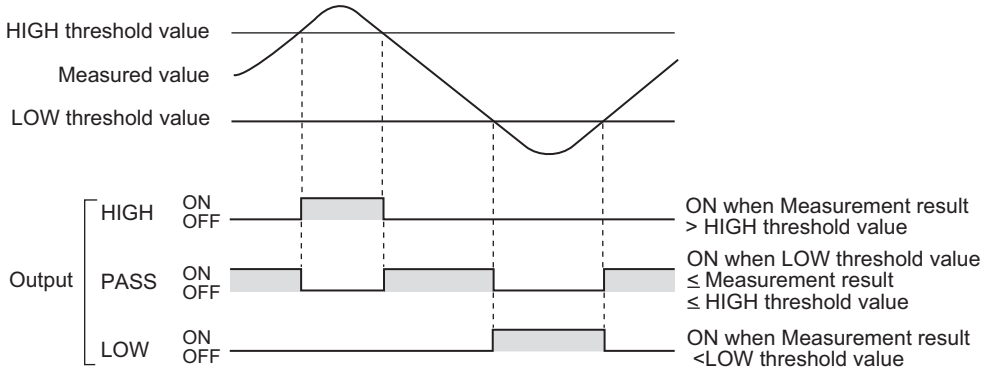
CHECK!

The zero reset function can also be canceled by supplying a ZERO signal to the 20-pole terminal block.

20-pole terminal block p.4-2
ZERO input p.4-8

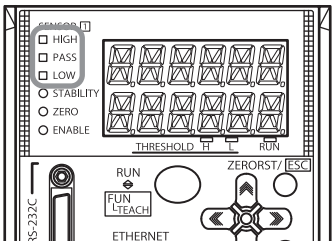
Setting Threshold Value

Switch the controller to the FUN mode and set the range in order for the measured value to be judged as PASS.
Both HIGH and LOW threshold values are set.
As a judgment result, HIGH, PASS or LOW is output.



A judgment result appears on the controller as follows:

- For judgment result HIGH: The HIGH indicator lights up.
- For judgment result PASS: The PASS indicator lights up.
- For judgment result LOW: The LOW indicator lights up.



There are two ways of setting the threshold value.

Method	Operating key	Details
Teaching	RUN / FUN TEACH	Performs measurement and uses the measurement results to set threshold values. Position teaching is useful when threshold samples, i.e., with the upper and lower limits, can be obtained beforehand.
Direct	◀ / ▶ / ▲ / ▼	The threshold values can be set by directly inputting numerical values. Direct input is useful when you know the dimensions for an OK judgment or when you want to fine-tune threshold values after teaching.

CHECK!

- Hysteresis (hysteresis width) can also be set to threshold values. Set hysteresis when measured values are dispersed around a threshold value, and judgments are unstable, to prevent chattering.

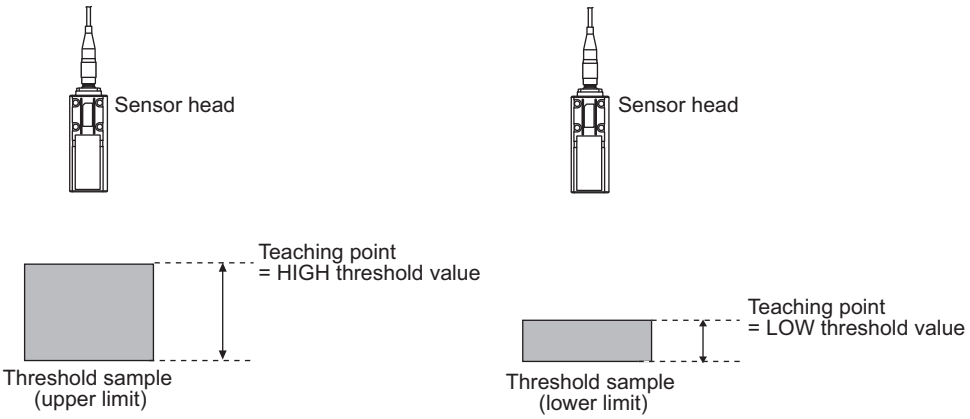
Settings for Judgment Output p.4-18

- Threshold values can also be adjusted by directly entering values in the RUN mode. This helps you to make fine adjustments without shutting down the system.

Threshold values change p.2-13

■ Teaching

Performs measurement and uses the measurement results to set threshold values.



Hold, trigger, and scaling settings that have been made before teaching are reflected in the teaching measurements.

As an example, here is an explanation of the procedure for setting the current measured value as a HIGH threshold value.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN/TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	MEAS	Press ≪ or ≫ keys to select either of "MEAS" and press ZERO/SET key.
3		TASK 1	Press ≪ or ≫ keys to select either of "TASK1" and press ZERO/SET key.
4		JUDGE	Press ≪ or ≫ keys to select either of "JUDGE" and press ZERO/SET key.
5		TEACH	Press ≪ or ≫ keys to select either of "TEACH" and press ZERO/SET key.
6		TEACH H.JUDGE	Select "HIGH threshold value" as the threshold value type. Press ≪ or ≫ keys to select either of "H.JUDGE" and press ZERO/SET key.

Steps	Key operation	Display	Description
7	RUN / FUN / TEACH	30.000 / 30.000 LIT H L RUN	The current measured value is displayed on the main display and the current set threshold value is displayed on the sub-display. (At that time, the THRESHOLD-H indicator lights up.) Press RUN/FUN/TEACH key to display the current measured value on the lower line.
8	ZERO/SET	-	Press ZERO/SET key to start a teaching. The indicator for the current measured value on the main display lights up, applying the value as a threshold value.
9	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Direct

The threshold values can be set by directly inputting numerical values.

As an example, here is an explanation of the procedure for setting a HIGH threshold value by entering "40.000" directly.

Operating procedure

Steps	Key operation	Display	Description
1 - 4	For moving to “JUDGE” see steps 1 to 4 in p.2-18		
5	ZERORST/ESC, ZERO/SET	diRECt	Press ◄ or ► keys to select either of "DIRECT" and press ZERO/SET key.
6		diRECt / HJUdGE	Select "HIGH threshold value" as the threshold value type. Press ◄ or ► keys to select either of "H.JUDGE" and press ZERO/SET key.
7	ZERORST/ESC, ZERO/SET	30.000 / 40.000 LIT H L RUN	Set "40.00" as the HIGH threshold value. The current measured value is displayed on the main display and the current set threshold value is displayed on the sub-display. (At that time, the THRESHOLD-H indicator lights up.) Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◄/► keys. Enter "40.00" and press ZERO/SET key.
8	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Bank Switching

Switches banks.

As an example, here is an explanation of the procedure for setting BANK2:

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	bANK	Press ◀◀ or ▶▶ keys to select either of "BANK" and press ZERO/SET key.
3		bK.CHG	Press ◀◀ or ▶▶ keys to select either of "BK.CHG" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	bK.CHG bANK2	Select BANK2 for the bank number. The current setting value is displayed on the sub-display. Press ▲ / ▼ keys to enter the editing mode, and the sub-display blinks. Select "BANK2" and press ZERO/SET key.
5	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

CHECK!

You can also switch the bank by entering the non-procedural command or from Smart Monitor ZW.

Current bank setting command <BS command> p.5-20
Smart Monitor ZW Operation Manual

Chapter 3
SETTINGS FOR FUNCTIONS

Setting Sensing 3-2
- Setting the Material for the Target to Measure 3-2
- Setting Exposure Time Control Mode 3-3

Setting Measurement Items 3-5
- Measuring the Height 3-6
- Measuring the Thickness 3-8
- Calculating 3-10

Setting the Output Conditions 3-14
- Setting the Filter 3-14
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Setting the Banks 3-43
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- Saving the Bank/System Settings 3-45
- Clearing the Bank Settings 3-46

Setting the System 3-47
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- Setting the Key Lock 3-49
- Initializing Settings 3-50

Setting Sensing

Setting the Material for the Target to Measure

Set the material for the target to measure.

Setting [Display] *	Description
Normal [NORMAL]	A measurement can be performed with a certain performance level regardless of the type of target to measure. Usually, select this setting.
Mirror surface [MIRROR]	Select this mode when specular reflection (regular reflection) occurs on the surface. (Glass, wafer, lustrous metal, etc.)
Diffusion surface [DIFF]	Select this mode when diffuse reflection occurs on the surface.

* [ ] following each setting indicates the main/sub-displays when that setting is selected. For example, if "Normal" is selected as the material, [NORMAL] will be displayed on the main display.

As an example, here is an explanation of the procedure for the "Mirror" setting as the material.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	SENS	Press ◀ or ▶ keys to select either of "SENS" and press ZERO/SET key.
3		OBJECT	Press ◀ or ▶ keys to select either of "OBJECT" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	OBJECT / MIRROR	Select "Mirror" as the material. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "MIRROR" and press ZERO/SET key.
5	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Setting Exposure Time Control Mode

Set the exposure time control mode and exposure time (upper limit or fixed value).

Setting [Display]	Description
Auto [AUTO]	Automatically sets the exposure time within the range that does not exceed the specified upper limit. Usually, select this setting. Upper limit range: 1 to 5,000 μs (default value: 1,000)
Manual [MANUAL]	Select this mode when you want to specify the exposure time, and set the exposure time (fixed value). range: 1 to 5,000 μs (default value: 1,000)

CHECK!

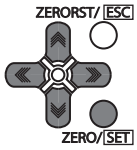
Exposure time and measuring cycle

- In "Auto" exposure time control mode, the measuring cycle twice the specified upper limit of the exposure time is used (The measuring cycle remains the same even if the actual exposure time is less than the upper limit).
- For the "Manual" exposure time control mode, the measuring cycle twice the exposure time is used. If the exposure time is 250 μs or less, the measuring cycle is set to 500 μs.

As an example, here is an explanation of the procedure for setting the exposure time control mode to "Auto" and the exposure time upper limit to "500 μs."

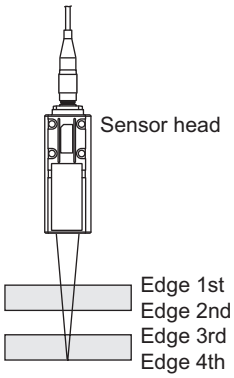
Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	SENS	Press ◀◀ or ▶▶ keys to select either of "SENS" and press ZERO/SET key.
3		EXPOSE	Press ◀◀ or ▶▶ keys to select either of "EXPOSE" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	EXPOSE AUTO	Select "AUTO" in the exposure time control mode. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "AUTO" and press ZERO/SET key.

Steps	Key operation	Display	Description
5			Set "500" as the upper limit for the exposure time. "UPPER" is displayed on the main display and the current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter "500" and press ZERO/SET key.
6			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Setting Measurement Items

Obtain the waveform data based on the specified sensing condition, and calculate the height/thickness of up to four surfaces included in the measuring range.
Count the measurement surface closest to the Sensor Head first.



Set the following measurement item based on the desired output for each task.

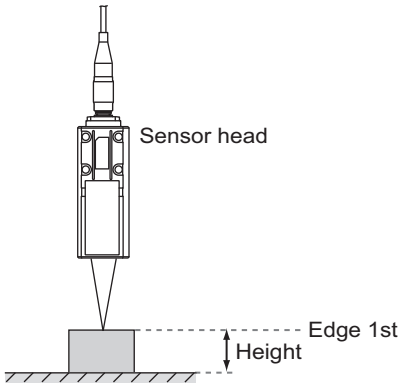
Setting [Display]	Description [Display]
Height [HEIGHT]	Measures the height. Specifies either of the following: - Edge 1st [EDGE1] - Edge 2nd [EDGE2] - Edge 3rd [EDGE3] - Edge 4th [EDGE4] - Light Peak [PEAK] (default value) (the surface receiving the largest amount of received light within the measuring range)
Thick [THICK]	Measures the thickness. Specifies either of the following for each of SURFACE1 [TOP] and SURFACE2 [END]: - Edge 1st [EDGE1] - Edge 2nd [EDGE2] - Edge 3rd [EDGE3] - Edge 4th [EDGE4] - Light Peak [PEAK] (default value) (the surface receiving the largest amount of received light within the measuring range)
Calculation [CALC]	Performs calculations using the output for each task.
None [NONE]	Select this when you don't perform the measurement.

CHECK!

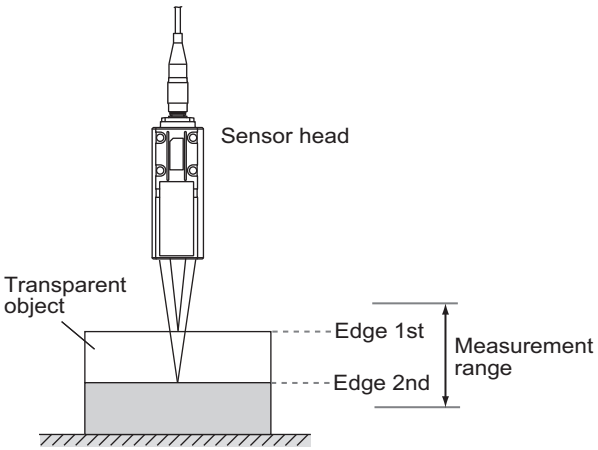
- The following are the initial values preset for the tasks.
  -TASK1: HEIGHT [HEIGHT]
  -TASK2 - TASK4: NONE [NONE]
- To check the measurement surface, use the SmartMonitor ZW to check the light reception waveform status.
  (Refer to Smart Monitor ZW Operation Manual).

Measuring the Height

The setting for common height measurements as shown in the following diagram is registered for TASK1 in advance. In such a case, this setting is not required.



Set this item when measuring the height of an object below a transparent object as shown in the following diagram.



Setting [Display]	Description [Display]
Measurement Surface [SUR]	Sets the measurement surface. - Edge 1st [EDGE1] - Edge 2nd [EDGE2] - Edge 3rd [EDGE3] - Edge 4th [EDGE4] - Light Peak [PEAK] (default value)

As an example, here is an explanation of the procedure for measuring the height of the surface (edge 2nd) below a transparent object (as shown in the diagram on the right on the previous page).

Operating procedure

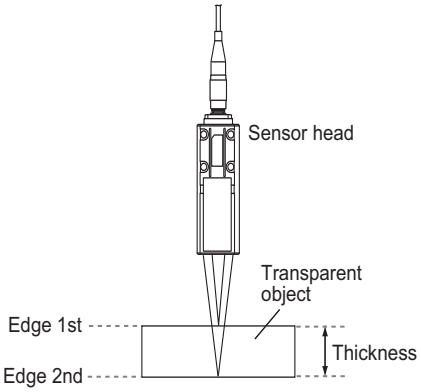
Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	MEAS	Press ◀◀ or ▶▶ keys to select either of "MEAS" and press ZERO/SET key.
3		TASK 1	Press ◀◀ or ▶▶ keys to select either of "TASK1" and press ZERO/SET key.
4		ITEM	Press ◀◀ or ▶▶ keys to select either of "ITEM" and press ZERO/SET key.
5	ZERORST/ESC, ZERO/SET	ITEM HEIGHT	Select "Height" as the measurement item. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "HEIGHT" and press ZERO/SET key.
6		SUR EDGE2	Select "Edge 2nd" as the measurement item. "SUR" is displayed on the main display and the current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "EDGE2" and press ZERO/SET key.
7	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

CHECK!

The Height [HEIGHT] in the Measurement Item [ITEM], and the Edge 1st [EDGE1] as the Measurement Surface [SUR] are specified in advance for TASK1. To measure the height in TASK2 to TASK4, set Edge 1st [EDGE1] first.

Measuring the Thickness

If you already know the glass thickness, you can adjust the scaling with reference to the thickness, and easily measure the thickness of a transparent object.

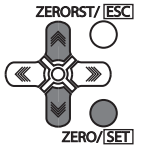
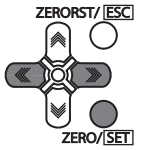
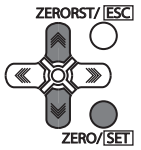
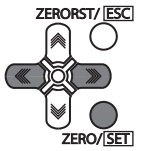
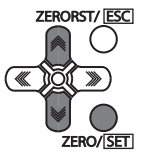


Setting [Display]	Description [Display]
Measurement Surface [TOP/ END]	Measures the thickness. Specifies either of the following for each of SURFACE1 [TOP] and SURFACE2 [END]: - Edge 1st [EDGE1] (default value (TOP)) - Edge 2nd [EDGE2] (default value (END)) - Edge 3rd [EDGE3] - Edge 4th [EDGE4] - Light Peak [PEAK]

As an example, here is an explanation of the procedure for selecting the setting for the measurement described in the diagram above.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN / FUN / TEACH key for two seconds to enter the FUN mode.
2	Set the material of the target to "MIRROR." Optional Setting the Material for the Target to Measure p.3-2 If the target object is a transparent object, such as glass, on which specular reflection occurs, set the material of the measurement object to "MIRROR" to obtain more accurate measurement result.		
3	Set the top to "Edge 1st."		

Steps	Key operation	Display	Description
3-1			Press ◀◀ or ▶▶ keys to select either of "MEAS" and press ZERO/SET key.
3-2			Press ◀◀ or ▶▶ keys to select either of "TASK1" and press ZERO/SET key.
3-3			Press ◀◀ or ▶▶ keys to select either of "ITEM" and press ZERO/SET key.
3-4			Select "Thick" as the measurement item. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "THICK" and press ZERO/SET key.
3-5			Select "Top." Press ◀◀ or ▶▶ keys to select either of "TOP" and press ZERO/SET key.
3-6			Select "Edge 1st" as the measurement surface. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "EDGE1" and press ZERO/SET key.
4	Set the end to "Edge 2nd."		
4-1			Press ZERORST/ESC key to return to the previous menu.
4-2			Select "End." Press ◀◀ or ▶▶ keys to select either of "END" and press ZERO/SET key.
4-3			Select "Edge 2nd" as the measurement surface. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "EDGE2" and press ZERO/SET key.
5	Set scaling Setting the Scaling p.3-21		
6			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Calculating

Perform calculations using the results calculated by the tasks.

Setting [Display]	Description [Display]
Calculation [CALC] K + mX + nY	Select this to perform logic operations on X and Y with the parameter freely set. In addition, you can assign, to TASK, the measurement of characteristic points you have set, and measure multiple points or perform calculations. - Parameter K range [PARAM.K]: -999.999999 to 999.999999 mm (default value: 0) - Parameter m range [PARAM.M]: -10.0 to 10.0 (default value: 0) - Parameter n range [PARAM.N]: -10.0 to 10.0 (default value: 0) - Parameter X range [PARAM.X]: None (default value), TASK1 to TASK4 - Parameter Y range [PARAM.Y]: None (default value), TASK1 to TASK4

As an example, here is an explanation of the output of the calculation result below.

(Example)

When calculating the amount of convexity and concavity on the workpiece surface from the difference between the average value and the peaks and outputting this to Task 3

TASK1: Surface peak hold

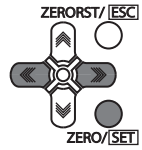
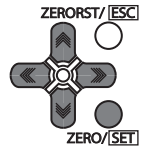
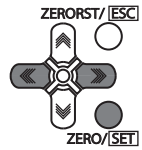
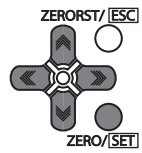
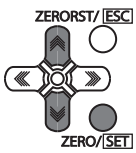
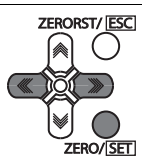
TASK2: Surface average hold

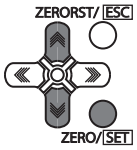
TASK3: Set TASK1 - TASK2

- Parameter K: 0
- Parameter m: 1
- Parameter n: -1
- Parameter X: TASK1
- Parameter Y: TASK2

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	MEAS	Press ◀ or ▶ keys to select either of "MEAS" and press ZERO/SET key.
3	Sets the surface peak hold for TASK1 and the surface average hold for TASK2. Setting the Hold p.3-28		
4	ZERORST/ESC, ZERO/SET	TASK3	Press ◀ or ▶ keys to select either of "TASK3" and press ZERO/SET key.
5		ITEM	Press ◀ or ▶ keys to select either of "ITEM" and press ZERO/SET key.
6	ZERORST/ESC, ZERO/SET	ITEM CALC	Select "Calculation" as the measurement item. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "CALC" and press ZERO/SET key.
7	ZERORST/ESC, ZERO/SET	PARAM.K	Select "Parameter K" for the parameter type. Press ◀ or ▶ keys to select either of "PARAM.K" and press ZERO/SET key.
8	ZERORST/ESC, ZERO/SET	PARAM.K 0.000000	Set the parameter to "0." The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter "0" and press ZERO/SET key.
9	ZERORST/ESC, ZERO/SET	PARAM.K 0.000000	The decimal point is displayed. Press ◀/▶ key to move the decimal point. Determine the decimal point and then press the ZERO/SET key.
10	ZERORST/ESC	PARAM.K	Press ZERORST/ESC key to return to the previous menu.

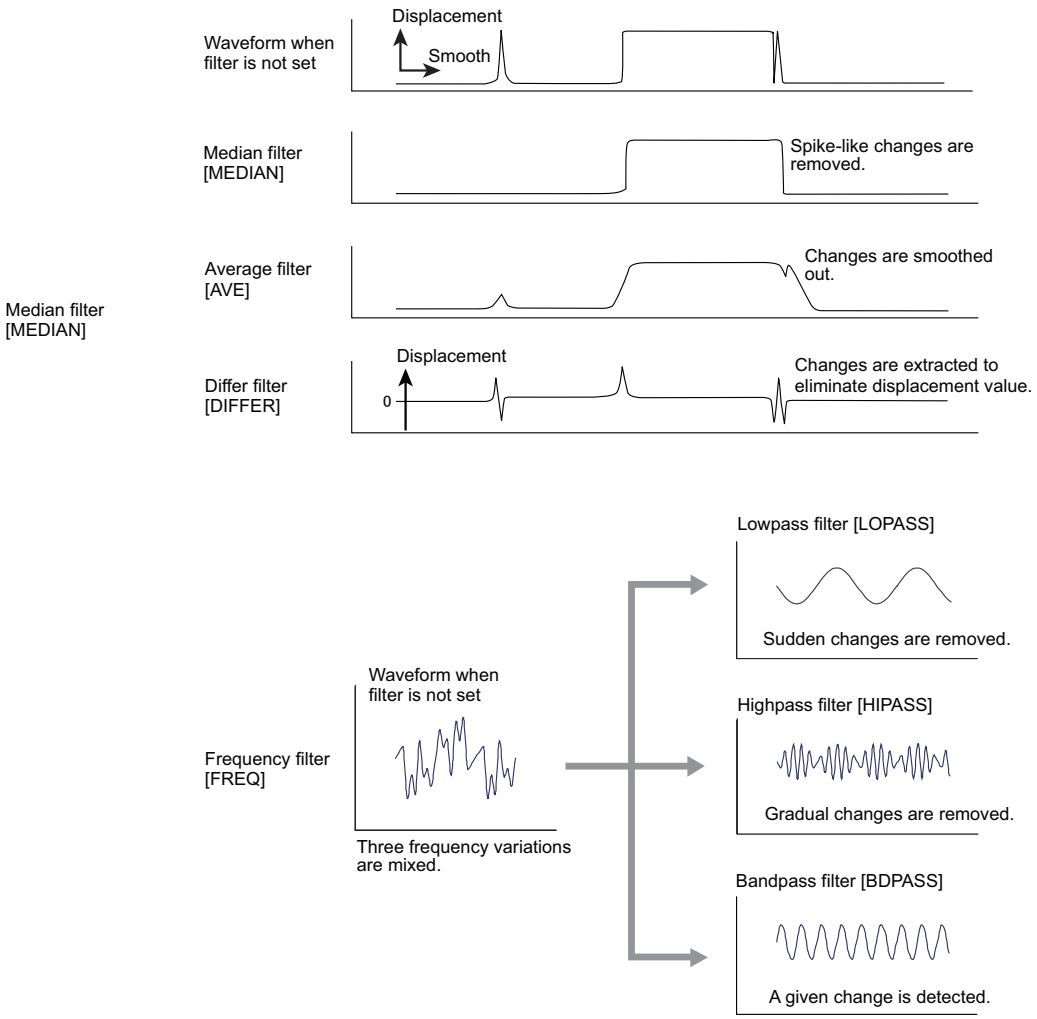
Steps	Key operation	Display	Description
11			Select "Parameter m" for the parameter type. Press ◀ or ▶ keys to select either of "PARAM.M" and press ZERO/SET key.
12			Set the parameter to "1." The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter "1" and press ZERO/SET key.
13			Press the ZERORST/ESC key to return to the previous menu.
14			Select "Parameter n" for the parameter type. Press ◀ or ▶ keys to select either of "PARAM.N" and press ZERO/SET key.
15			Set the parameter to "-1." The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter "-1" and press ZERO/SET key.
16			Press ZERORST/ESC key to return to the previous menu.
17			Select "Parameter X" for the parameter type. Press ◀ or ▶ keys to select either of "PARAM.X" and press ZERO/SET key.
18			Set the parameter to "TASK1." The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "TASK1" and press ZERO/SET key.
19			Press ZERORST/ESC key to return to the previous menu.
20			Select "Parameter Y" for the parameter type. Press ◀ or ▶ keys to select either of "PARAM.Y" and press ZERO/SET key.

Steps	Key operation	Display	Description
21			Set the parameter to "TASK2." The current setting value is displayed on the sub-display. Press ∧ / ∨ keys to enter the editing mode, and the sub-display blinks. Select "TASK2" and press ZERO/SET key.
22			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Setting the Output Conditions

Setting the Filter

Set the filter condition when filtering information obtained from the sensor.
The following types of filters can be set depending on purpose.



■ Setting the median filter

The intermediate value of multiple sets of data can be output as the measurement result.

Setting [Display]	Description
Low [LOW]	Outputs the intermediate value of the last 3 measurements.
Mid [MID]	Outputs the intermediate value of the last 9 measurements.
High [HIGH]	Outputs the intermediate value of the last 15 measurements.
Off [OFF] (Default value)	Median filter is not used.

As an example, here is an explanation of the procedure for selecting the "Mid" median filter setting.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / L-TEACH	UNLIT H L RUN	Press RUN/FUN/L-TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	MEAS	Press ≪ or ≫ keys to select either of "MEAS" and press ZERO/SET key.
3		TASK 1	Press ≪ or ≫ keys to select either of "TASK1" and press ZERO/SET key.
4		FILTER	Press ≪ or ≫ keys to select either of "FILTER" and press ZERO/SET key.
5		MEdI AN	Select "Median filter" as the filter type. Press ≪ or ≫ keys to select either of "MEDIAN" and press ZERO/SET key.
6	ZERORST/ESC, ZERO/SET	MEdI AN MI d	Select "Mid" as the median filter type. The current setting value is displayed on the sub-display. Press ∧ / ∨ keys to enter the editing mode, and the sub-display blinks. Select "MID" and press ZERO/SET key.
7	RUN / FUN / L-TEACH	LIT H L RUN	Press RUN/FUN/L-TEACH key for two seconds to enter the RUN mode.

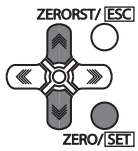
■ Setting the average value filter

The average of the measured values obtained based on the preset number of samples can be output. Select this setting when you want to ignore sudden changes in measured values.

Setting	Description
1/2/4/8/16/32/64/128/256/512/ 1024/2048/4096 (Default value: 256)	Sets the average count.

As an example, here is an explanation of the procedure for selecting the "128" average count setting.

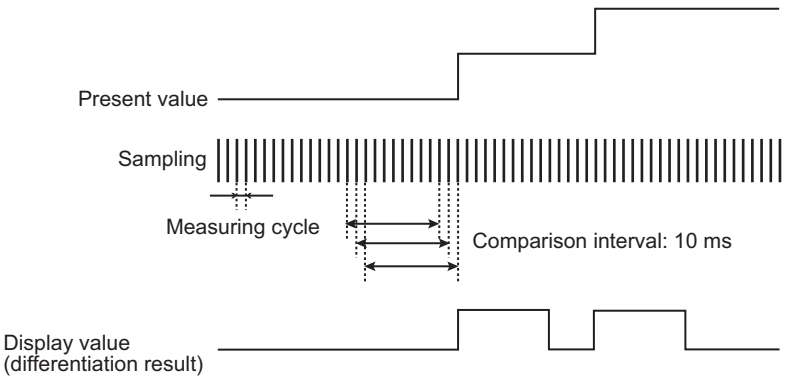
Operating procedure

Steps	Key operation	Display	Description
1 - 4	For moving to FILTER, see steps 1 to 4 in p.3-15		
5			Select "Average filter" as the filter type. Press ◀◀ or ▶▶ keys to select either of "AVE" and press ZERO/SET key.
6			Select "128" as the average count. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "128" and press ZERO/SET key.
7			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Setting the differ filter

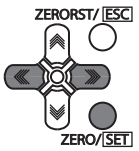
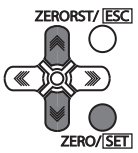
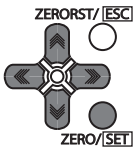
Use the differentiation function to detect only sudden changes in the measured values that occur during very short periods of time.
The differentiation function detects changes between the present value and the measured value that is in effect just before the comparing pitch. The coefficient of this comparing pitch is defined as the differentiation cycle.

Example: Differentiation cycle = 10 ms



As an example, here is an explanation of the procedure for selecting the "10 ms" differentiation filter cycle setting.

Operating procedure

Steps	Key operation	Display	Description
1 - 4	For moving to FILTER, see steps 1 to 4 in p.3-15		
5			Select "Differ filter" as the filter type. Press ◀◀ or ▶▶ keys to select either of "DIFFER" and press ZERO/SET key.
6			Enable the differential filter. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
7			Set "10" as the differential cycle. "CYCLE" is displayed on the main display and the current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀◀/▶▶ keys. Enter "10" and press ZERO/SET key.

Steps	Key operation	Display	Description
8			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Setting the frequency filter

Set a filter to ignore or detect the changes in a specific frequency in the measured data.

Setting [Display]	Description
Lowpass Filter [LO.PASS]	Ignores frequency components larger than the specified cut-off frequency. (Only gradual changes are captured.) Range of cut-off frequency: 0.001 - 999.999 Hz *1 (Default value: 0.001)
Highpass Filter [HI.PASS]	Detects frequency components smaller than the specified cut-off frequency. (Sudden changes are captured.) Range of cut-off frequency: 0.001 - 999.999 Hz *1 (Default value: 0.001)
Bandpass Filter [BD.PASS]	Detects the frequency components between the cut-off frequency (lower limit) and the cut-off frequency (upper limit). Sets the upper and lower limits of the frequency bandwidth to be detected. Range: Upper limit 0.001 - 999.999 Hz *1 (Default value: 999.999) Lower limit 0.001 - 999.999 Hz *1 (Default value: 0.001)
Off [OFF] (Default value)	Frequency filter is not used.

*1 Set the cut-off frequency to a value smaller than one-half of the sampling frequency. Otherwise, the frequency filter will not function properly. If a value outside of the appropriate range is set, the frequency filter will be applied with the values included in the range.

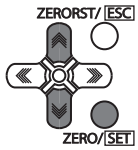
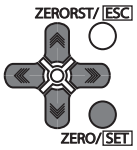
*2 If the cut-off frequency values (upper/lower limits) are too close, the frequency bandwidth to be detected cannot be properly detected.

- The sampling frequency is the inverse of the sampling cycle.
- The measuring cycle can be viewed in the "System Information" menu.

Checking Information p.3-47

As an example, here is an explanation of the procedure for selecting the "Lopass filter" setting for the frequency filter type, and the "1 Hz" cut-off frequency filter setting.

Operating procedure

Steps	Key operation	Display	Description
1 - 4	For moving to FILTER, see steps 1 to 4 in p.3-15		
5			Select "Frequency filter" as the filter type. Press ◀◀ or ▶▶ keys to select either of "FREQ" and press ZERO/SET key.
6			Select "Lowpass filter" as the frequency filter type. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "LO.PASS" and press ZERO/SET key.
7			Set "1" as the cut-off frequency. "CUTOFF" is displayed on the main display and the current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀◀/▶▶ keys. Enter "1" and press ZERO/SET key.
8			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Setting the Scaling

This setting is used when you want to correct any errors that are generated due to the installation status of the Sensor Head,
and display the corrected value on the main display as a measured value.
There are three types of setting: "auto scaling" ("one-point scaling" and "two-point scaling") that automatically sets the correction value of a placed sensing object, "manual scaling" that manually sets the correction value and "thickness scaling" that sets the sensing object (transparent object) and automatically sets the correction value.

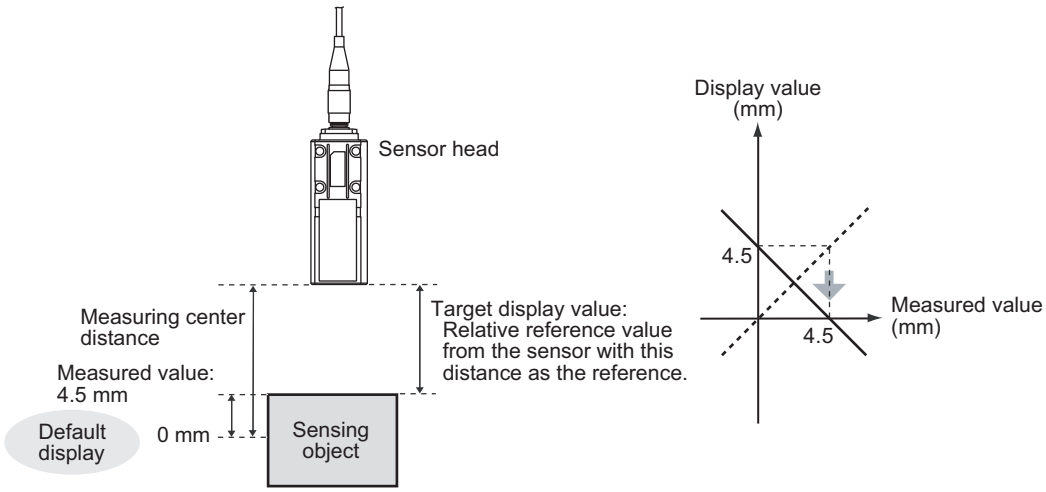
CHECK!

The "zero Reset" (p.3-37) settings return to the default settings when scaling is set. If scaling is set, perform a zero reset as necessary.

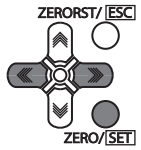
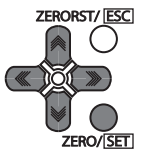
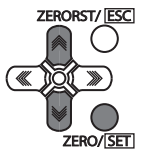
● **One-point scaling**

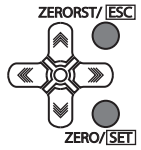
A measurement is performed at one position and offset values are set for that measured value.
The offset and increment/decrement inversion can be set. (Default value: OFF)

Example: When displaying the distance to the sensing object



Operating procedure

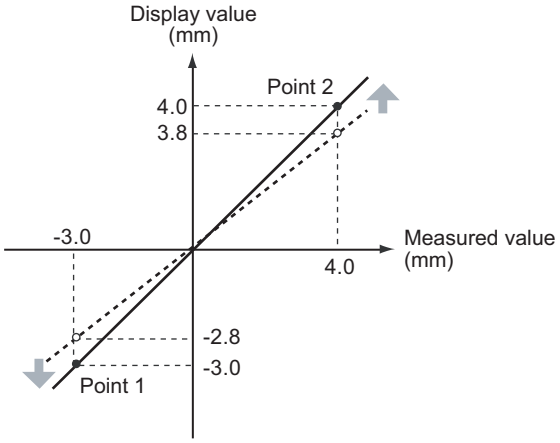
Steps	Key operation	Display	Description
1			Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2			Press ≪ or ≫ keys to select either of "MEAS" and press ZERO/SET key.
3			Press ≪ or ≫ keys to select either of "TASK1" and press ZERO/SET key.
4			Press ≪ or ≫ keys to select either of "OUTPUT" and press ZERO/SET key.
5			Press ≪ or ≫ keys to select either of "SCALE" and press ZERO/SET key.
6			Select "AUTO" as the scaling type. The current setting value is displayed on the sub-display. Press ≪ / ≫ keys to enter the editing mode, and the sub-display blinks. Select "AUTO" and press ZERO/SET key.
7			Select "One point." Press ≪ or ≫ keys to select either of "1PT" and press ZERO/SET key.
8			Press ZERO/SET key when the main display shows "POINT1."
9			The current measured value is displayed on the main display and the current setting value is displayed on the sub-display. To edit numerical values use ≪ / ≫ / ≪ / ≫ keys. Enter the setting value and then press ZERO/SET key.
10			Set the increment/decrement direction. "DIR" is displayed on the main display and the incremental/decremental directions ("FWD": the NEAR side as + and "REV": the FAR side as +) are displayed on the sub-display. Press ≪ / ≫ keys to enter the editing mode, and the sub-display blinks. Select "AUTO" and press ZERO/SET key.

Steps	Key operation	Display	Description
11			"OK/CAN" is displayed on the sub-display. Press ZERO/SET key to execute the scaling or ZERORST/ESC key to cancel.
12			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

● **Two-point scaling**

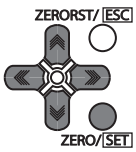
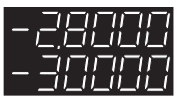
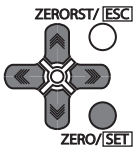
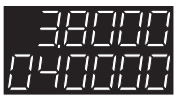
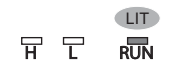
A measurement is performed at two positions and offset values are set for that measured value. (Default value: OFF)

Example: When correcting display values to match actual distances



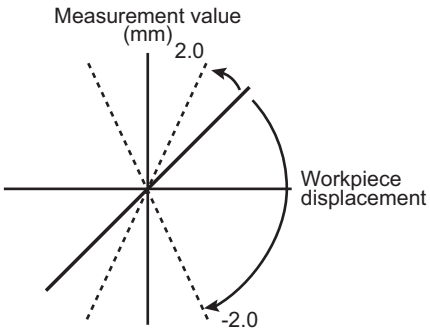
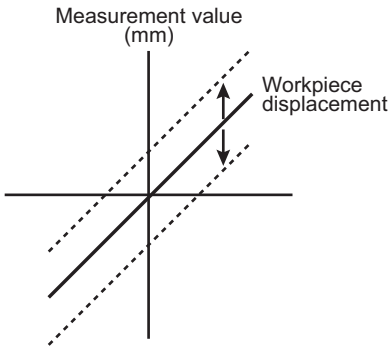
CHECK! Separate the two specified points by at least 1 % of the rated measuring range for the connected Sensor Head.
For example, for ZW-S40, the two measured points must be separated by at least 12 mm x 0.01 = 0.12 mm as the measuring range is 12 mm × 6 mm).

Operating procedure

Steps	Key operation	Display	Description
1 - 6	For moving to SCALE - AUTO, see steps 1 to 6 in p.3-22		
7			Press ◀ or ▶ keys to select either of "2PT" and press ZERO/SET key.
8			Press ZERO/SET key when the main display shows "POINT1."
9			Set the measured value of point 1. The current measured value is displayed on the main display and the current setting value is displayed on the sub-display. To edit numerical values use ▲/▼/◀/▶ keys. Enter the setting value and then press ZERO/SET key.
10			Press ZERO/SET key when the main display shows "POINT2."
11			Set the measured value of point 2. To edit numerical values use ▲/▼/◀/▶ keys. Enter the setting value and then press ZERO/SET key.
12			"OK/CAN" is displayed on the sub-display. Press ZERO/SET key to execute the scaling or ZERORST/ESC key to cancel.
13			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

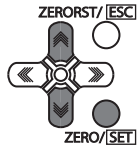
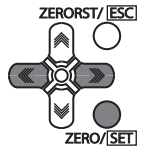
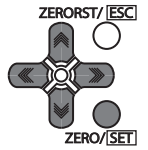
■ Manual scaling

Set the scaling by entering the correction value.

Setting [Display]	Description
Span [SPAN]	Sets the inclination of the sensor characters as a coefficient. Range: -2.0000 to 2.0000 (Default value: 1.0000) 
Offset [OFFSET]	Adds/subtracts a fixed value to or from the measured value. Range: -999.999999 to 999.999 (Default value: 0) 

As an example, here is an explanation of the procedure for selecting the "Span" setting for the manual scaling type, and the "1.2" inclination coefficient setting.

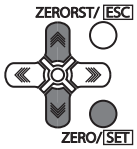
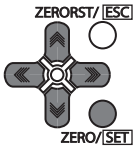
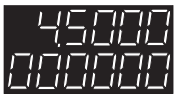
Operating procedure

Steps	Key operation	Display	Description
1 - 5	For moving to SCALE, see steps 1 to 5 in p.3-22		
6			Select "Manual" as the scaling type. The current setting value is displayed on the sub-display. Press ▲ / ▼ keys to enter the editing mode, and the sub-display blinks. Select "MANUAL" and press ZERO/SET key.
7			Set "Span" as the manual scaling type. Press ◀ or ▶ keys to select either of "SPAN" and press ZERO/SET key.
8			Set "1.2" in the inclination coefficient. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲ / ▼ / ◀ / ▶ keys. Enter "500" and press ZERO/SET key.
9			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Thickness scaling

The thickness is measured at one position and offset values are set for that measured value.

Operating procedure

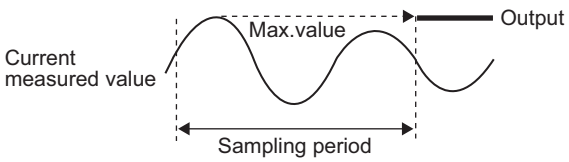
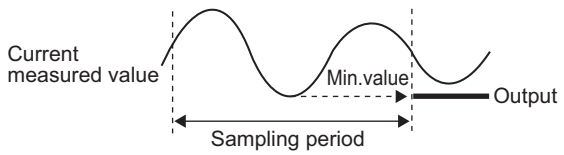
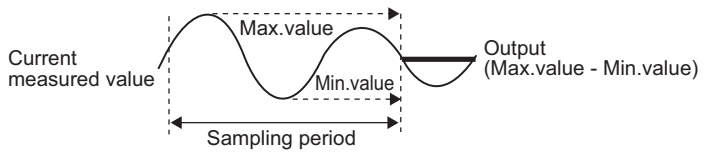
Steps	Key operation	Display	Description
1 - 5	For moving to SCALE, see steps 1 to 5 in p.3-22		
6			Select "Thick" as the scaling type. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "THICK" and press ZERO/SET key.
7			The current measured value is displayed on the main display and the current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter the setting value and then press ZERO/SET key.
8			"OK/CAN" is displayed on the sub-display. Press ZERO/SET key to execute the scaling or ZERORST/ESC key to cancel.
9			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

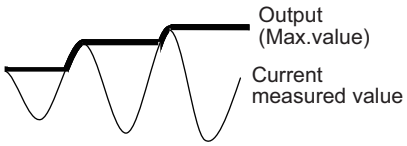
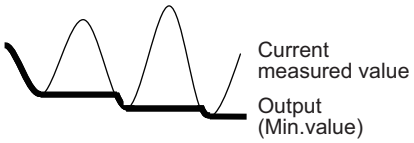
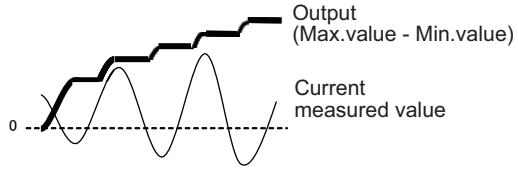
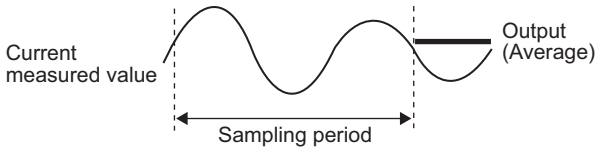
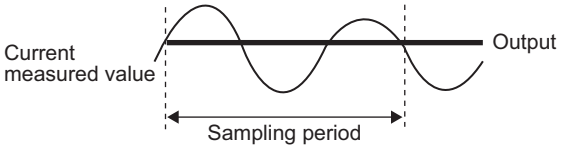
Setting the Hold

Set the hold conditions for measured values. The hold functions hold any value from the measured values during the specific period (sampling period), such as the maximum or minimum value.

■ Type

Set the hold conditions for measured values.

Setting [Display]	Description
Peak [PEAK]	Holds the maximum value during the sampling period. The output changes at the end of the sampling period and is held until the end of the next sampling period. 
Bottom [BOTTOM]	Holds the minimum value during the sampling period. The output changes at the end of the sampling period and is held until the end of the next sampling period. 
Peak to Peak [P-P]	Holds the difference between the maximum and minimum values during the sampling period. This option is selected mainly when detecting vibration. The output changes at the end of the sampling period and is held until the end of the next sampling period. 

Setting [Display]	Description
Auto peak [AUTOPK]	Holds the "maximum value" of the measurement result. The output changes every time the maximum value is updated. 
Auto bottom [AUTOBT]	Holds the "minimum value" of the measurement result. The output changes every time the minimum value is updated. 
Auto peak to peak [AUTOPP]	Holds the difference between the maximum and minimum values of the measurement result. The output changes every time the maximum or the minimum value is updated. 
Average [AVE]	Holds the average measured value during the sampling period. The output changes at the end of the sampling period and is held until the end of the next sampling period. 
Sample [SAMPLE]	Holds the measured value at the start of the sampling period. The output changes at the start of the sampling period and is held until the start of the next sampling period. 

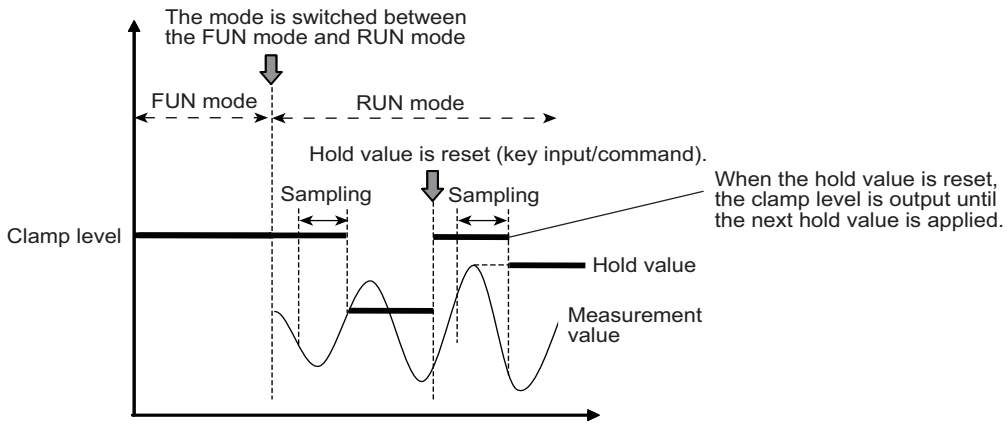
Setting [Display]	Description
Off [OFF]	The hold function is not used. The measured value is always output.

● **Hold clearing conditions**

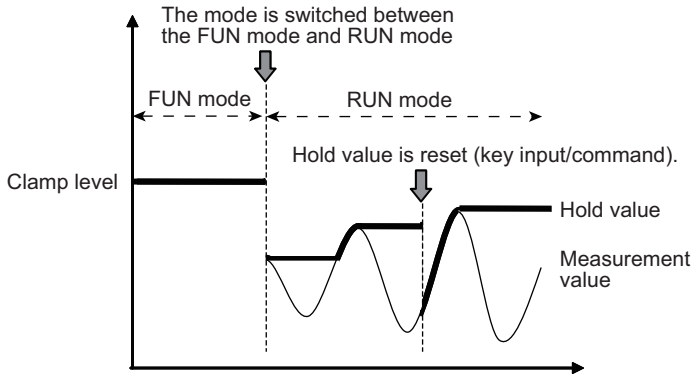
The values held can be cleared by the following operation.

- The mode is switched between the FUN mode and RUN mode.
- Hold reset is entered. (key)
- Hold reset command is entered.

Example: Peak



Example: Auto peak



CHECK!

If an abnormal measured value is obtained during sampling, the hold value is cleared. To not clear the hold value even if an abnormal measured value is obtained, set "Keep" as the non-measurement setting.

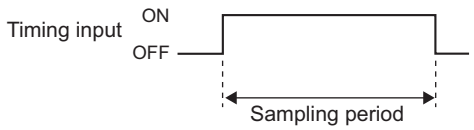
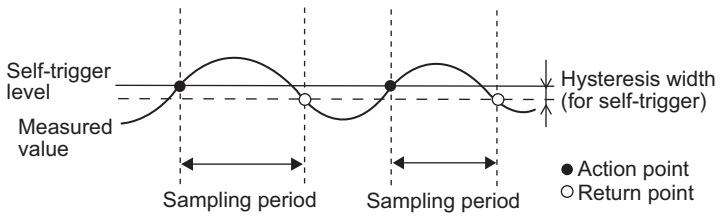
As an example, here is an explanation of the procedure for selecting the "Peak" hold type setting.

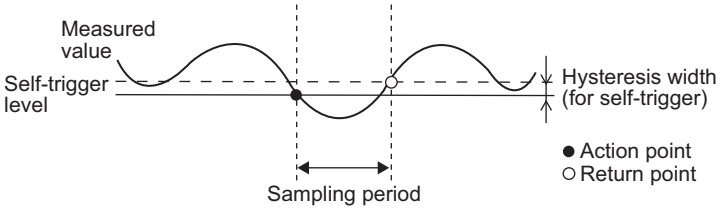
Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / L-TEACH	UNLIT H L RUN	Press RUN/FUN/L-TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	MEAS	Press ≪ or ≫ keys to select either of "MEAS" and press ZERO/SET key.
3		tASK 1	Press ≪ or ≫ keys to select either of "TASK1" and press ZERO/SET key.
4		OUtPUt	Press ≪ or ≫ keys to select either of "OUTPUT" and press ZERO/SET key.
5		HOLd	Press ≪ or ≫ keys to select either of "HOLD" and press ZERO/SET key.
6		tYPE	Press ≪ or ≫ keys to select either of "TYPE" and press ZERO/SET key.
7	ZERORST/ESC, ZERO/SET	tYPE / PEAK	Select "Peak" as the hold type. The current setting value is displayed on the sub-display. Press ∧ / ∨ keys to enter the editing mode, and the sub-display blinks. Select "PEAK" and press ZERO/SET key.
8	RUN / FUN / L-TEACH	LIT H L RUN	Press RUN/FUN/L-TEACH key for two seconds to enter the RUN mode.

■ Triggers

Set the input method for the timing of the start and end of the measurement period.

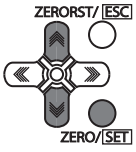
Setting [Display]	Description
Timing [TIMING] (Default value)	Enters the trigger for the start of sampling by using the timing input. The period that the timing signal is ON is the sampling period.  CHECK! When a delay time is set, the input OFF timing and the end of the sampling period will not be synchronous. Sampling will end after the specified sampling period has elapsed.
Self-up [SELF-U]	The sampling period is the period at which the measured value is greater than the specified self-trigger level. Hold measurement is possible without a sync input.  When Self-up is selected, the following items are subsequently displayed: • Trig level [LEVEL] Sets the desired self-trigger level. Range: -999.999999 to 999.999999 (Default value: 0) • Trig hys [HYS] Sets the hysteresis width for the self-trigger. Range: 0 to 999.999999 (Default value: 0.05 % of measurement range) CHECK! When a delay time is set, the timing when the measured value becomes smaller than the self-trigger level and the end of the sampling period will not be synchronous. Sampling will end after the specified sampling period has elapsed.

Setting [Display]	Description
Self-down [SELF-D]	The sampling period is the period at which the measured value is smaller than the specified self-trigger level. Hold measurement is possible without a sync input.  When Self-down is selected, the following items are subsequently displayed: • Trig level [LEVEL] Sets the desired self-trigger level. Range: -999.999999 to 999.999999 (Default value: 0) • Trig hys [HYS] Sets the hysteresis width for the self-trigger. Range: 0 to 999.999999 (Default value: 0.05 % of measurement range) CHECK! When a delay time is set, the timing when the measured value becomes greater than the self-trigger level and the end of the sampling period will not be synchronous. Sampling will end after the specified sampling period has elapsed.

CHECK! Set the hysteresis width based on the fluctuations in the measured values around the trigger level. The hysteresis will be applied from the start of the measuring period and will prevent timing input chattering.

As an example, here is an explanation of the procedure for selecting the "Timing" trigger type setting.

Operating procedure

Steps	Key operation	Display	Description
1 - 5	For moving to HOLD, see steps 1 to 5 in p.3-31		
6	 	 	Press ≪ or ≫ keys to select either of "TRIG" and press ZERO/SET key.
7	 	 	Select "Timing" as the trigger type. "TYPE" is displayed on the main display and the current setting value is displayed on the sub-display. Press ∧ / ∨ keys to enter the editing mode, and the sub-display blinks. Select "TIMING" and press ZERO/SET key.

Steps	Key operation	Display	Description
8	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

● **When holding with a key input**

Press ∧ or ∨ key on the controller to enable the trigger input or reset input.

• Trigger input is ON while ∧ key is pressed.

• Reset input is ON when ∨ key is pressed.

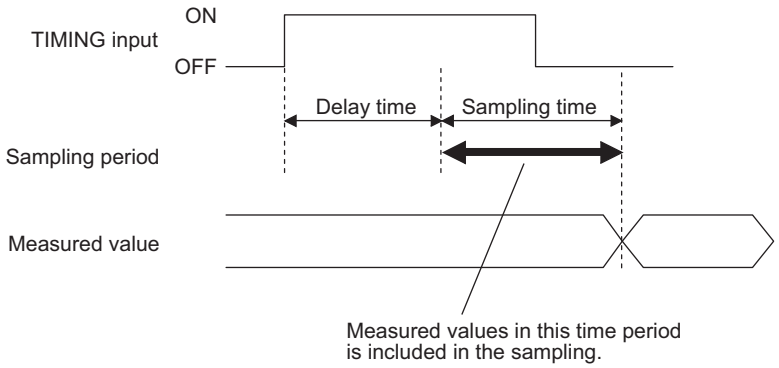
Note that the key input is disabled in the default setting. Set the following when using this function.

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	SYSTEM	Press ≪ or ≫ keys to select either of "SYSTEM" and press ZERO/SET key.
3		KEY.IN	Press ≪ or ≫ keys to select either of "KEY.IN" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	KEY.IN ON	Enable the key input. The current setting value is displayed on the sub-display. Press ∧ / ∨ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
5	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Delay

A delay time is set to ignore measured values immediately after the TIMING input. This is useful for avoiding bounding during device startup and the influence of machine vibration.

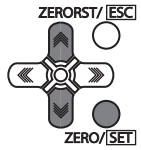
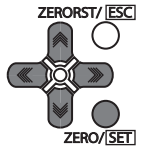
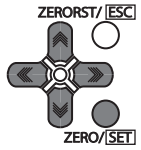
The delay time (the delay between TIMING input and the start of sampling) and the sampling time can be set.



Setting [Display]	Description
On [ON]	Sets the delay time and the sampling time. The following is set when ON is selected. • Delay time [DLY.TIM] Sets the delay time. Range: 1 to 5000 ms (Default value: 1) • Sampling time [SMP.TIM] Sets the sampling time. Range: 1 to 5000 ms (Default value: 100) • CHECK! Set so that the "delay time + sampling time" is less than the timing input ON interval. If the next timing input for measurement is received before the "delay time + sampling time" has elapsed, that timing input will be ignored and will not be reflected in the sampling.
Off [OFF] (Default value)	The delay time is not set.

As an example, here is an explanation of the procedure for selecting the "10 ms" delay time and sampling time settings.

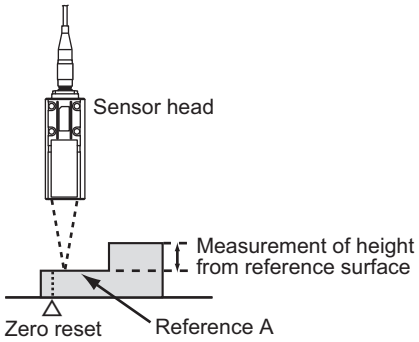
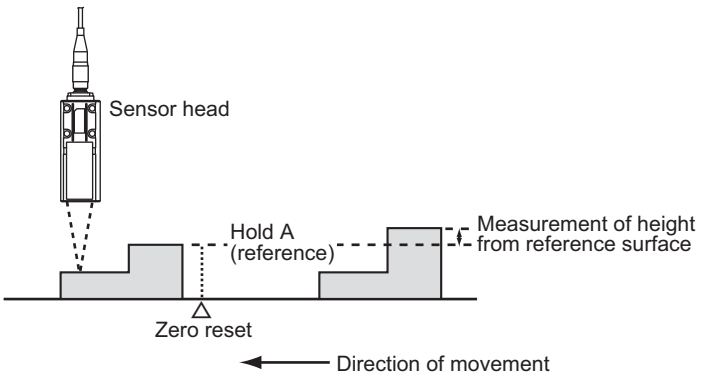
Operating procedure

Steps	Key operation	Display	Description
1 - 5	For moving to HOLD, see steps 1 to 5 in p.3-31		
6			Press ◀ or ▶ keys to select either of "DELAY" and press ZERO/SET key.
7			Enable the delay. "DELAY" is displayed on the main display and the current setting value is displayed on the sub-display. Press ▲ / ▼ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
8			Select the “Delay time”. Press ◀ or ▶ keys to select either of "DLY.TIM" and press ZERO/SET key.
9			Set "10" as the delay time. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲ / ▼ / ◀ / ▶ keys. Enter "10" and press ZERO/SET key.
10			Press ZERORST/ESC key to return to the previous menu.
11			Select the “Sampling time”. Press ◀ or ▶ keys to select either of "SMP.TIM" and press ZERO/SET key.
12			Set "10" as the sampling time. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲ / ▼ / ◀ / ▶ keys. Enter "10" and press ZERO/SET key.
13			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Setting the Zero Reset

■Type

Set how zero reset is to be executed.

Setting [Display]	Description
Real value [REAL] (Default value)	Sets the measured value when a zero reset is executed to zero. 
Hold value [HOLD]	Sets the measured value (hold value) when a zero reset is executed to zero. This setting is enabled when hold measurement is performed. 

As an example, here is an explanation of the procedure for selecting the "Real value" zero reset type setting.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	MEAS	Press ◀ or ▶ keys to select either of "MEAS" and press ZERO/SET key.
3		TASK 1	Press ◀ or ▶ keys to select either of "TASK1" and press ZERO/SET key.
4		OUTPUT	Press ◀ or ▶ keys to select either of "OUTPUT" and press ZERO/SET key.
5		ZERO	Press ◀ or ▶ keys to select either of "ZERO" and press ZERO/SET key.
6		TYPE	Press ◀ or ▶ keys to select either of "TYPE" and press ZERO/SET key.
7	ZERORST/ESC, ZERO/SET	TYPE / REAL	Select "Real value" as the zero reset type. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "REAL" and press ZERO/SET key.
8	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■Offset

Set an offset to set the reference value for zero reset to a value other than 0.

Setting [Display]	Description
Offset [OFFSET]	Sets the reference value. Range: -999.999999 to 999.999999 mm (Default value: 0)

As an example, here is an explanation of the procedure for selecting the "10 mm" reference value setting.

Operating procedure

Steps	Key operation	Display	Description
1 - 5	For moving to ZERO, see steps 1 to 5 in p.3-38		
6			Press ◀ or ▶ keys to select either of "OFFSET" and press ZERO/SET key.
7			Set "10" as the reference value. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter "10" and press ZERO/SET key.
8			The decimal point is displayed. Press ◀/▶ key to move the decimal point. Determine the decimal point and then press the ZERO/SET key.
9			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■Status

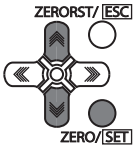
Set valid/invalid for the zero reset function.

Setting [Display]	Description
On [ON] (Default value)	When a zero reset input is received externally, a zero reset is executed.
Off [OFF]	Even when a zero reset input is received externally, a zero reset is not executed.

CHECK! The status is set for each task.

As an example, here is an explanation of the procedure for selecting the "ON" (Enabled) zero reset type setting.

Operating procedure

Steps	Key operation	Display	Description
1 - 5	For moving to ZERO, see steps 1 to 5 in p.3-38		
6			Press ◀ or ▶ keys to select either of "STATUS" and press ZERO/SET key.
7			Enable the zero reset. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
8			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

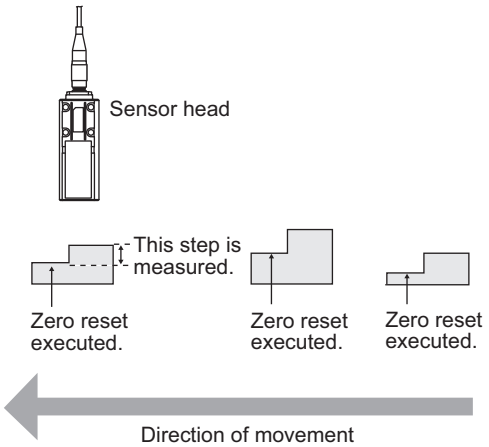
■ Zero reset memory

Select whether or not to hold the measured value zero reset level even if the power is turned OFF.

Setting [Display]	Description
On [ON]	The zero reset level is saved to memory even if the power is turned OFF.
Off [OFF] (Default value)	Zero reset is canceled when the power is turned OFF.

Turn [OFF] zero reset memory if, as in the example below, the zero point is reset for each measurement.

Example: When the step of the sensing object is measured



CHECK!

- If zero reset memory is [ON], the zero reset level data will be written in the Sensor Controller non-volatile memory (EEPROM) at each zero reset. The EEPROM can be written a maximum of 1,000,000 times. Writing the zero reset level for each measurement can, therefore, use up the life of the memory and lead to malfunctions.
- Even if zero reset memory is enabled, the zero reset level will be held also when it is saved. Zero reset will continue after startup when these functions have been changed.

As an example, here is an explanation of the procedure for selecting the "ON" (Enabled) zero reset memory setting.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	SYSTEM	Press ◀ or ▶ keys to select either of "SYSTEM" and press ZERO/SET key.
3		ZER.MEM	Press ◀ or ▶ keys to select either of "ZER.MEM" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	ZER.MEM ON	Enable the zero reset memory. The current setting value is displayed on the sub-display. Press ▲ / ▼ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
5	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Setting the Banks

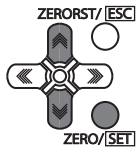
Changing the Bank Mode

Select the bank contents to be obtained from the settings or judgment value.

Setting [Display]	Description
Normal [NORMAL] (Default value)	Sensing setting, measurement setting and I/O setting that are set in the FUN mode are regarded as bank data. The number of banks is up to eight.
Judgment [JUDGE]	Only the threshold value under the measurement setting is regarded as bank data. The number of banks increases up to 32.

As an example, here is an explanation of the procedure for selecting the "Normal" bank mode setting.

Operating procedure

Steps	Key operation	Display	Description
1			Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2			Press ≪ or ≫ keys to select either of "BANK" and press ZERO/SET key.
3			Press ≪ or ≫ keys to select either of "BK.MODE" and press ZERO/SET key.
4			Select "Normal" as the bank mode. The current setting value is displayed on the sub-display. Press ≪ / ≫ keys to enter the editing mode, and the sub-display blinks. Select "NORMAL" and press ZERO/SET key.
5			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Copying the Bank Settings

Copy the selected bank setting to another bank.

As an example, here is an explanation of the procedure for copying the BANK1 setting to BANK4.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN/TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	bANK	Press ◀◀ or ▶▶ keys to select either of "BANK" and press ZERO/SET key.
3		bK.COPY	Press ◀◀ or ▶▶ keys to select either of "BK.COPY" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	FROM bANK 1	Select "BANK1" as the bank setting to be copied. "FROM" is displayed on the main display and the current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "BANK1" and press ZERO/SET key.
5		TO bANK4	Select "BANK4" as the target to copy the bank setting. "TO" is displayed on the main display and the current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "BANK4" and press ZERO/SET key.
6	RUN / FUN/TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Saving the Bank/System Settings

Save the bank/system settings to the controller.

CHECK!

- The settings of all banks are saved regardless of the currently selected bank number.
- After you have made or changed settings, be sure to save the setup data. All settings will be deleted if you turn the power OFF without saving the data.

Here is an explanation of the procedure for saving the bank/system settings.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN/TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	SYSTEM	Press ◀◀ or ▶▶ keys to select either of "BANK" and press ZERO/SET key.
3		SAVE	Press ◀◀ or ▶▶ keys to select either of "SAVE" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	SAVE OK/CAN	"OK/CAN" is displayed on the sub-display. Press ZERO/SET key to save the setting or ZERORST/ESC key to cancel.
5	RUN / FUN/TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Clearing the Bank Settings

Clear (Initialize) the setting of the currently selected bank.

CHECK!

Settings in system setting and settings displayed in RUN mode are not initialized.

Here is an explanation of the procedure for clearing the bank.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	bANK	Press ≪ or ≫ keys to select either of "BANK" and press ZERO/SET key.
3		bK.CLR	Press ≪ or ≫ keys to select either of "BK.CLR" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	bK.CLR OK/CAN	"OK/CAN" is displayed on the sub-display. Press ZERO/SET key to clear the bank setting or ZERORST/ESC key to cancel.
5	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Setting the System

Display/set the system environment.

Checking Information

Displays the set measuring cycle and information of the controller and Sensor Head.

Setting [Display]		Description
Measuring cycle [CYCLE]		Displays the currently set measuring cycle (unit: ms).
Controller Information [C.INFO]	Version [VER]	Displays the model information of the controller.
	MAC address [MAC.ADR]	Displays the MAC address that is set.
Sensor head Information [H.INFO]	Model [MODEL]	Displays the model information of the Sensor Head obtained from the Calibration ROM (ZW-S_ _).
	Serial No. [SER.NO]	Displays the serial number of the Sensor Head (last 6 digits).

As an example, here is an explanation of the procedure for displaying the serial number of the Sensor Head.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	SYSTEM	Press ◀ or ▶ keys to select either of "SYSTEM" and press ZERO/SET key.
3	-	H.INFO	Press ◀ or ▶ keys to select either of "H.INFO" and press ZERO/SET key.
4	-	SER.NO	Press ◀ or ▶ keys to select either of "SER.NO" and press ZERO/SET key.
5	-	SER.1 / 12345b	"SER.1" is displayed on the main display and the upper-order digit is displayed on the sub-display.

Steps	Key operation	Display	Description
6			When the ≪/≫ key is pressed, "SER.2" is displayed on the main display and the lower-order digit is displayed on the sub-display.
7			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

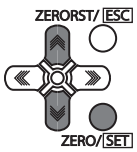
Setting the Key Lock

The key lock function disables all Controller keys.
Once the key lock is set, no key input will be accepted until the lock is released. This function is useful to prevent inadvertent changes to settings.
Note that, moving to the key lock setting menu or moving between menu hierarchies are possible even when the key lock function is ON.

Setting [Display]	Description
On [ON]	Turns the key lock function ON.
Off [OFF] (Default value)	Release the key lock function.

Here is an explanation of the procedure for turning the key lock ON.

Operating procedure

Steps	Key operation	Display	Description
1			Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2			Press ◀ or ▶ keys to select either of "SYSTEM" and press ZERO/SET key.
3			Press ◀ or ▶ keys to select either of "LOCK" and press ZERO/SET key.
4			Turns the key lock function ON. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
5			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Initializing Settings

Returns all banks/system settings to their default settings.

CHECK!

- The settings of all banks/system settings are returned to the default settings regardless of the currently selected bank number.
- Parameters for which the default values are decided by the Sensor Head measuring range (Hys, Trigger hys, HIGH Threshold, LOW Threshold) are all set to the default value of "0", which is the factory default.

Here is an explanation of the procedure for restoring the default settings.

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN/TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	SYSTEM	Press ≪ or ≫ keys to select either of "SYSTEM" and press ZERO/SET key.
3		INIT	Press ≪ or ≫ keys to select either of "INIT" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	INIT OK/CAN	"OK/CAN" is displayed on the sub-display. Press ZERO/SET key to return the settings to their default settings or ZERORST/ESC key to cancel.
5	RUN / FUN/TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Chapter 4
I/O SETTINGS

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I/O Terminal Names and Functions

The following describes the names and functions of the Controller I/O terminals (20-pole terminal block, 52-pole extension connector).

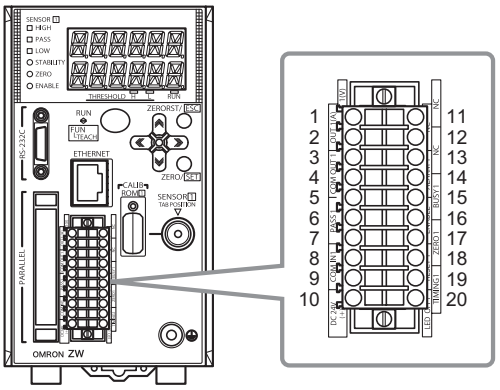
I/O Terminal Functions

The following summarizes the I/O terminals and explains their functions.

■ 20-pole terminal block

Used for judgment output, control input, etc.

Compatible cable specifications: AWG 18 to 28, pin processed length: 7 mm



No.	Signal name	Description	No.	Signal name	Description
1	OUT1 (V)	Sensor Head 1 analog voltage output Outputs the measured value, ±10 V	11	NC	Not used
2	OUT1 (A)	Sensor Head 1 analog current output Outputs the measured value, 4 to 20 mA	12	NC	Not used
3	OUT1 0V	0 V for Sensor Head 1 analog voltage output	13	NC	Not used
4	COM_OUT 1	COM1 for output	14	ALARM1	Sensor Head 1 ALARM output
5	HIGH1	Sensor Head HIGH judgment output	15	BUSY1	Sensor Head 1 BUSY output
6	PASS1	Sensor Head PASS judgment output	16	ENABLE	ENABLE output
7	LOW1	Sensor Head LOW judgment output	17	ZERO1	Sensor Head 1 ZERO input
8	COM_IN1	COM1 for input	18	RESET1	Sensor Head 1 RESET input
9	DC24V (-)	0 V input for power supply	19	TIMING1	Sensor Head 1 TIMING input
10	DC24V (+)	24 V input for power supply	20	LED OFF1	Sensor Head 1 LED OFF input

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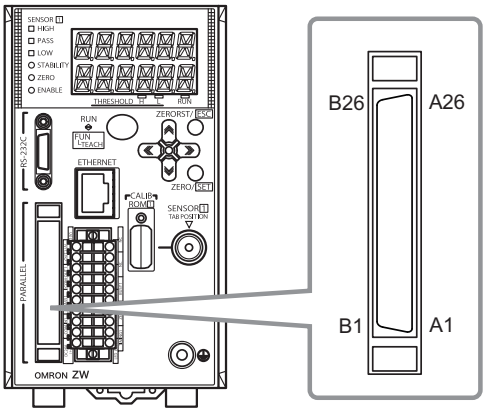
■ 52-pole extension connector

Used for bank number selection input, binary output object task selection input, binary output, etc.

Compatible connector: FX2B series (Hirose Electric Co., Ltd.)

A parallel cable (ZW-XCP2) for an extension connector with 2 m cable is available. (See p.6-15)



No.	Signal name	Description	ZW-XCP2 cable color
A1	BINARY20	Binary output	Brown
A2	BINARY19		Red
A3	BINARY18		Orange
A4	BINARY17		Yellow
A5	BINARY16		Green
A6	BINARY15		Blue
A7	BINARY14		Purple
A8	BINARY13		Gray
A9	BINARY12		White
A10	BINARY11		Black
A11	BINARY10		Brown
A12	COM_OUT4	COM4 for output	Red
A13	COM_OUT4		Orange
A14	BINARY9	Binary output	Yellow
A15	BINARY8		Green
A16	BINARY7		Blue
A17	BINARY6		Purple
A18	BINARY5		Gray
A19	BINARY4		White
A20	BINARY3		Black
A21	BINARY2		Brown

No.	Signal name	Description	ZW-XCP2 cable color
A22	BINARY1	Binary output	Red
A23	BINARY0		Orange
A24	GATE	GATE signal output	Yellow
A25	COM_OUT3	COM3 for output	Green
A26	COM_OUT3		Blue
B1	BANK_OUT3	Bank number output	Brown
B2	BANK_OUT2		Red
B3	BANK_OUT1		Orange
B4	NC	Not used	Yellow
B5	BINARY_OUT2	Binary output task number output	Green
B6	BINARY_OUT1		Blue
B7	NC	Not used	Purple
B8	NC		Gray
B9	NC		White
B10	NC		Black
B11	NC		Brown
B12	COM_OUT2	COM2 for output	Red
B13	COM_OUT2		Orange
B14	NC	Not used	Yellow
B15	NC		Green
B16	BINARY_SEL2	Binary output object task selection input	Blue
B17	BINARY_SEL1		Purple
B18	BANK_SEL3	Bank selection input	Gray
B19	BANK_SEL2		White
B20	BANK_SEL1		Black
B21	NC	Not used	Brown
B22	NC		Red
B23	NC		Orange
B24	NC		Yellow
B25	COM_IN2	COM2 for input	Green
B26	COM_IN2		Blue

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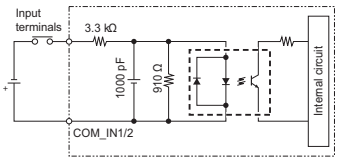
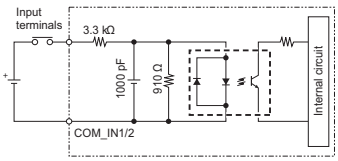
Electrical Specifications

■ Input circuit

Item	Specifications	
Model	ZW-C10T/C10AT	ZW-C15T/C15AT
Input type	NPN	PNP
Input voltage	DC24 V±10 % (21.6 to 26.4 V)	DC24 V±10 % (21.6 to 26.4 V)
Input current	7 mA TYP (DC24 V)	7 mA TYP (DC24 V)j
ON voltage/ON current *1	19 V min./3 mA min.	19 V min./3 mA min.
OFF voltage/OFF current *2	5 V max./1 mA max.	5 V max./1 mA max.
ON delay	0.1 ms max.	0.1 ms max.
OFF delay	0.1 ms max.	0.1 ms max.
Internal circuit diagram *3		

*1 ON voltage/ON current

This is the voltage value or current value that makes the signal go OFF to ON.

The ON voltage value becomes the potential difference between COM IN 1/2 and the input terminals.

*2 OFF voltage/OFF current

This is the voltage value or current value that makes the signal go ON to OFF.

The OFF voltage value becomes the potential difference between COM IN 1/2 and the input terminals.

*3 Below is a table giving the COM_IN (input common) and input signal connection correspondence.

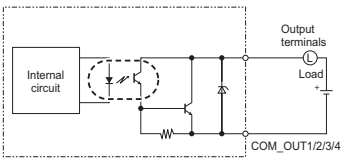
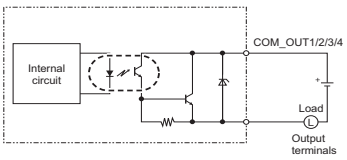
Terminal name	20-pole terminal block COM_IN1	52-pole extension connector COM_IN2
Input terminal name	ZERO1	BANK_SEL1
	RESET1	BANK_SEL2
	TIMING1	BANK_SEL3
	LED OFF1	BINARY_SEL1
		BINARY_SEL2
		BANK_CHG

CHECK!

Chattering countermeasures

- The sensor is designed with functions to deal with chattering, but if chattering of 100 μs or more occurs, incorrect input due to chattering cannot be prevented. (Input signal changes of less than 100 μs are ignored. The input signal is applied when the same level is maintained for 100 μs or longer.)
- Always use non-contact relays (SSR, PLC transistor output) for input signals. If contact relays are used, contact bounding may input a trigger again during measuring.

■ Output circuit

Item	Specifications	
Model	ZW-C10T/C10AT	ZW-C15T/C15AT
Output type	NPN	PNP
Output voltage	DC21.6 to 30 V	DC21.6 to 30 V
Load current	20-pole terminal block: 50 mA max. 52-pole extension connector: 30 mA max.	20-pole terminal block: 50 mA max. 52-pole extension connector: 30 mA max.
ON residual voltage	1.2 V max.	1.2 V max.
ON leakage current	0.1 mA max.	0.1 mA max.
Internal circuit diagram *1		

*1 Below is a table giving the COM_OUT (output common) and output signal connection correspondence.

Terminal name	20-pole terminal block	52-pole extension connector		
	COM_OUT1	COM_OUT2	COM_OUT3	COM_OUT4
Output terminal name	HIGH1	BINARY_OUT1	GATE	BINARY10
	PASS1	BINARY_OUT2	BINARY0	BINARY11
	LOW1	BANK_OUT1	BINARY1	BINARY12
	ALARM1	BANK_OUT2	BINARY2	BINARY13
	BUSY1	BANK_OUT3	BINARY3	BINARY14
	ENABLE		BINARY4	BINARY15
			BINARY5	BINARY16
			BINARY6	BINARY17
			BINARY7	BINARY18
			BINARY8	BINARY19
			BINARY9	BINARY20

CHECK!

Connect a load that matches the output specifications. Short-circuit can cause sensor breakdown.

I/O Signal Functions

The following describes the functions of I/O signals.

■ 20-pole terminal block

● Analog output

Name	Description
Analog voltage output	This outputs the measured value, from -10 V to +10 V as the voltage value. When measurement not possible: Approx. +10.8 V (default value; can be selected by user) Alarm: Approx. +10.8 V
Analog current output	This outputs the measured value; from 4 mA to 20 mA as the current value. When measurement not possible: Approx. +21 mA (default value; can be selected by user) Alarm: Approx. +21 mA

● Judgment output

Name	Description
HIGH output	This outputs judgment results - HIGH (HIGH threshold values < Measured value).
PASS output	This outputs judgment results - PASS (LOW threshold values ≤ Measured value ≤ HIGH threshold values).
LOW output	This outputs judgment results -LOW (LOW threshold values > Measured value).

● ALARM output

Name	Description
ALARM output	This turns ON when there is a system error.

● BUSY output

Name	Description
BUSY output	This turns ON during sampling with the hold function enabled. It allows you to check whether or not the self-trigger is functioning correctly. It also turns ON during bank switching.

● ENABLE output

Name	Description
ENABLE output	This turns ON when the sensor is ready for measurement. This output is interlocked with the ENABLE indicator.

● ZERO input

Name	Description
ZERO input	This is used to execute and clear a zero reset.

● RESET input

Name	Description
RESET input	This resets all executing measurements and outputs. While a RESET is being input, judgment output conforms to the non-measurement setting. If this RESET input switches ON while the hold function is used, the state in effect before the hold function was set will be restored.

● TIMING input

Name	Description
TIMING input	This timing input is for signal input from external devices. Use it for hold function timing.

● LED OFF input

Name	Description
LED OFF input	This LED-OFF signal puts out the measurement LED. While LED-OFF is being input, the analog output, binary output, and judgment output conform to the non-measurement setting.

■ 52-pole extension connector

● Binary output

Name	Description
BINARY output	This outputs the measurement result or judgment value as binary. The measured value is output converted to 21 bits of binary data. All the task judgment results can be output together.

● GATE signal output

Name	Description
GATE output	This is the timing signal for taking in binary data with external devices. When the GATE signal is ON, take in the binary data.

● Bank number output

Name	Description
BANK_OUT output	This outputs the currently specified bank number. It expresses the bank number in combinations of BANK_OUT1, 2 and 3.

Bank Number	BANK_OUT1	BANK_OUT2	BANK_OUT3
BANK1	OFF	OFF	OFF
BANK2	ON	OFF	OFF
BANK3	OFF	ON	OFF
BANK4	ON	ON	OFF
BANK5	OFF	OFF	ON
BANK6	ON	OFF	ON
BANK7	OFF	ON	ON
BANK8	ON	ON	ON

● Binary output task number output

Name	Description
BINARY_OUT output	This outputs the task number currently output as binary. It expresses the task number in combinations of BINARY_OUT1 and 2.

Bank Number	BINARY_OUT1	BINARY_OUT2
TASK1	OFF	OFF
TASK2	ON	OFF
TASK3	OFF	ON
TASK4	ON	ON

● Binary output object task selection input

Name	Description
BINARY_SEL input	This selects which task's data is output as binary. Specify the task number in combinations of BINARY_SEL1 and 2. It is only enabled in RUN mode.

Bank Number	BINARY_SEL1	BINARY_SEL2
TASK1	OFF	OFF
TASK2	ON	OFF
TASK3	OFF	ON
TASK4	ON	ON

● Bank selection input

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>BANK_SEL input</td><td>This is used for switching banks.
Specify the bank number in combinations of BANK_SEL1, 2 and 3.
However, if the bank mode is set to "JUDGEMENT", the bank cannot be switched at the external signal input because the number of banks increases to 32.
<table>
<tr><th>Bank Number</th><th>BANK_SEL1</th><th>BANK_SEL2</th><th>BANK_SEL3</th></tr>
<tr><td>BANK1</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>BANK2</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>BANK3</td><td>OFF</td><td>ON</td><td>OFF</td></tr>
<tr><td>BANK4</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>BANK5</td><td>OFF</td><td>OFF</td><td>ON</td></tr>
<tr><td>BANK6</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>BANK7</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>BANK8</td><td>ON</td><td>ON</td><td>ON</td></tr>
</table></td></tr>
</table>

Settings for I/O

The following describes settings for I/O.

Settings for Analog Output

The following describes the settings for outputting the current measurement results from the analog output of the 20-pole terminal block.

■ Output destination setting

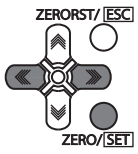
With analog output, the measurement results can be output converted into a current from 4 to 20 mA or a voltage from -10 to +10 V.
Selects which to output, the current or the voltage.

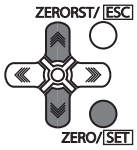
Setting [Display]	Description [Display]
Voltage output [VOLT] (Default value)	Voltage output
Current output [CUR.]	Current output

The same output destination is set for all banks. The output destination cannot be set separately for individual banks.

As an example, here is an explanation of the procedure for outputting the voltage.

Operating procedure

Steps	Key operation	Display	Description
1			Press RUN FUN TEACH key for two seconds to enter the FUN mode.
2			Press ◀ or ▶ keys to select either of "I/O" and press ZERO/SET key.
3			Press ◀ or ▶ keys to select either of "ANALOG" and press ZERO/SET key.
4			Press ◀ or ▶ keys to select either of "V OR C" and press ZERO/SET key.

Steps	Key operation	Display	Description
5			Select "Voltage output" as the output destination. The current setting value is displayed on the sub-display. Press ∧/∨ keys to enter the editing mode, and the sub-display blinks. Select "VOLT" and press ZERO/SET key.
6			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Assignment of analog output

Sets the task for which to output the results as analog.

Setting [Display]	Description
TASK1 [TASK1] (Default value)	The measured value for the selected task is output from the Controller as analog.
TASK2 [TASK2]	
TASK3 [TASK3]	
TASK4 [TASK4]	
OFF [OFF]	No analog output.

As an example, here is an explanation of the procedure for outputting the results of TASK1 as analog.

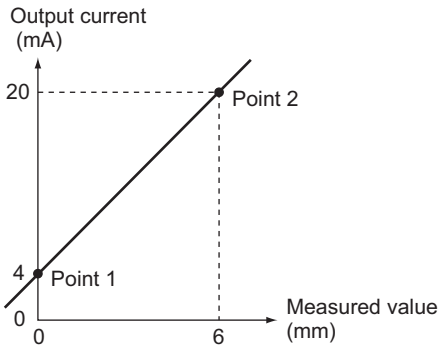
Operating procedure

Steps	Key operation	Display	Description
1 - 3	For moving to ANALOG, see steps 1 to 3 in p.4-12		
4			Press ∧ or ∨ keys to select either of "OUTPUT" and press ZERO/SET key.
5			Select "TASK1" as the task to output for. The current setting value is displayed on the sub-display. Press ∧/∨ keys to enter the editing mode, and the sub-display blinks. Select "TASK1" and press ZERO/SET key.
6			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Setting focus

For the analog output, because the measured value is converted to a current of 4 to 20 mA or a voltage of -10 to +10, and is then output, you can freely set the relationship between the displayed measured value and output value.
Match the settings to suit the connected external device.
Enter the output values for any two current values or voltage values to set the output range.

Example: When setting 4 mA output (Point 1) for measured value of 0 mm and 20 mA output for measured value of 6 mm (Point 2) (current output)

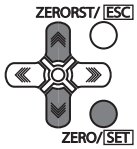
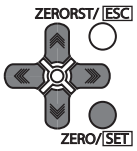
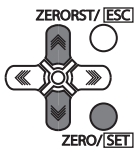
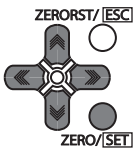
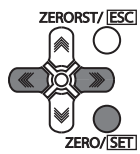
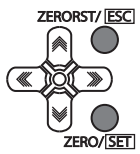


CHECK! Separate the two specified points by at least 1% of the rated measuring range of the connected Sensor Head or 40 μm.
For example, for a ZW-S40, the two measured points must be separated by at least 12 mm x 0.01 = 0.12 mm as the measuring range is 12 mm (±6 mm).

As an example, here is an explanation of the procedure for setting 4 mA output (Point 1) for measured value of 0 mm and 20 mA output for measured value of 6 mm (Point 2).

Operating procedure

Steps	Key operation	Display	Description
1 - 3	For moving to ANALOG, see steps 1 to 3 in p.4-12		
4			Press ◀ or ▶ keys to select either of "FOCUS" and press ZERO/SET key.

Steps	Key operation	Display	Description
5			The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
6			Set "4 mA" as the Point 1 output value. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "4mA" and press ZERO/SET key.
7			Set "0" as the Point 1 measured value. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter "0" and press ZERO/SET key.
8			The decimal point is displayed. Press ◀/▶ key to move the decimal point. Determine the decimal point and then press ZERO/SET key.
9			Set "20 mA" as the Point 2 output value. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "20mA" and press ZERO/SET key.
10			Set "6" as the Point 1 measured value. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀/▶ keys. Enter "6" and press ZERO/SET key.
11			The decimal point is displayed. Press ◀/▶ key to move the decimal point. Determine the decimal point and then press ZERO/SET key.
12			"OK/CAN" is displayed on the sub-display. Press ZERO/SET key to put the setting into effect or ZERORST/ESC key to cancel.
13			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Correcting analog output values

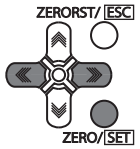
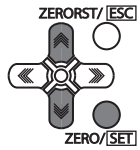
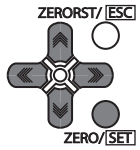
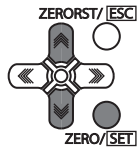
Discrepancies may occur between the current value/voltage value output as analog set on the Controller and the current value/voltage value actually measured due to the conditions for the connected external device or other factors.
The analog output correction function can be used to correct this discrepancy.
The output values are corrected by entering the correction value for the current or voltage values for any two points. (Setting range: -999 to +999, default value: 0)

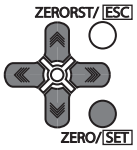
CHECK!

Set the output type and select either current or voltage output beforehand. Also, connect the analog output signal line to an external ammeter or voltmeter.

As example, here is an explanation of the procedure for correcting 4 mA output (Point 1) and 20 mA output (Point 2).

Operating procedure

Steps	Key operation	Display	Description
1 - 3	For moving to ANALOG, see steps 1 to 3 in p.4-12		
4			Press ◀◀ or ▶▶ keys to select either of "CALIB" and press ZERO/SET key.
5			The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
6			The current set value for Point 1 is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "4mA" and press ZERO/SET key.
7			Correct the Point 1 output. Press ▲/▼/◀◀/▶▶ keys to input the correction value and press ZERO/SET key. Next, check the ammeter value and press ZERO/SET key. To re-adjust, press ZERORST/ESC key.
8			The current set value for Point 2 is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "20mA" and press ZERO/SET key.

Steps	Key operation	Display	Description
9			Correct the Point 2 output. Press ▲/▼/◀/▶ keys to input the correction value and press ZERO/SET key. Next, check the ammeter value and press ZERO/SET key. To re-adjust, press ZERORST/ESC key.
10			"OK/CAN" is displayed on the sub-display. Press ZERO/SET key to execute the correction or ZERORST/ESC key to cancel.
11			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Settings for Judgment Output

The following describes the settings for outputting the judgment results from the judgment output of the 20-pole terminal block.

■ Assignment of judgment output

Sets the task for which to output the judgment results.

Setting [Display]	Description
TASK1 [TASK1] (Default value)	The judgment results for the selected task are output from the following output terminals of the 20-pole terminal block. • HIGH1 • PASS1 • LOW1 • BUSY1
TASK2 [TASK2]	
TASK3 [TASK3]	
TASK4 [TASK4]	

CHECK! With binary output, judgment results for all the tasks can be output.

Settings for Binary Output p.4-22

As an example, here is an explanation of the procedure for outputting the judgment results for TASK1.

Operating procedure

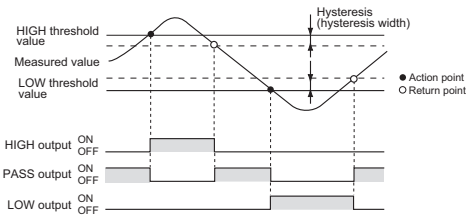
Steps	Key operation	Display	Description
1	RUN ⇔ FUN/TEACH	UNLIT H L RUN	Press RUN ⇔ FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	I/O	Press ≪ or ≫ keys to select either of "I/O" and press ZERO/SET key.
3		JUDGE	Press ≪ or ≫ keys to select either of "JUDGE" and press ZERO/SET key.
4		OUTPUT	Press ≪ or ≫ keys to select either of "OUTPUT" and press ZERO/SET key.
5	ZERORST/ESC, ZERO/SET	OUTPUT TASK1	Select "TASK1" as the task to output judgment for. The current setting value is displayed on the sub-display. Press ≪ / ≫ keys to enter the editing mode, and the sub-display blinks. Select "TASK1" and press ZERO/SET key.

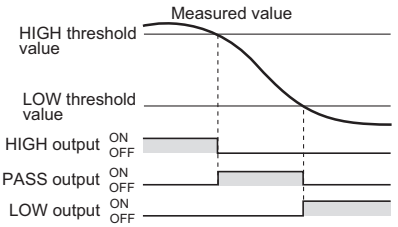
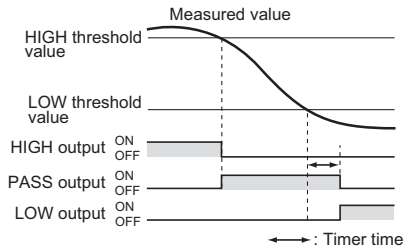
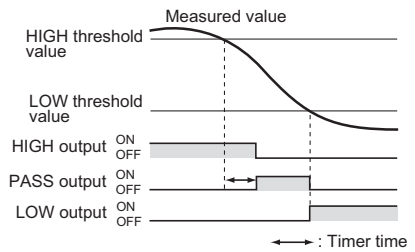
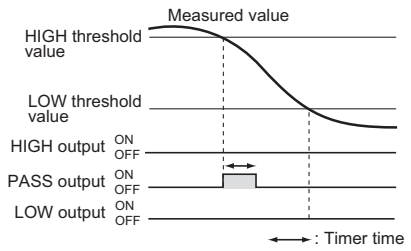
Steps	Key operation	Display	Description
6	RUN / FUN / TEACH	LIT H L RUN	Press RUN / FUN / TEACH key for two seconds to enter the RUN mode.

■ Operation settings at judgment output

Sets the hysteresis width for the upper and lower limits of judgments and the judgment output timing.

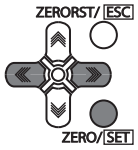
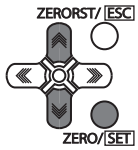
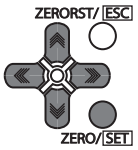
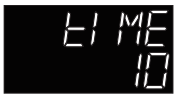
Setting Threshold Value p.2-17

Setting [Display]	Description	
Hys [HYS]	Set the hysteresis value for the upper and lower limits of judgments if the HIGH, PASS, or LOW judgment is unstable near the threshold values. Hysteresis width setting range: Range: 0 to 99.9999 (default value: 0.05 % of Sensor Head measuring range) Example: For the ZW-S40, 12 mm x 0.05% = 0.006 mm, as the range is ±6 mm.	

Setting [Display]		Description	
Timer [TIMER]		Set the timing for judgment outputs to match the operation of external devices.	
	Off [OFF] (Default value)	Outputs the judgment as soon as the judgment result has been applied.	
	Off delay [OFF.DLY]	After the measurement result has been applied, delays turning OFF the PASS output for the time set to the timer. Timer time setting range: 1 to 5000 ms (default value: 1)	
	On delay [ONDLY]	After the measurement result has been applied, delays turning ON the PASS output for the time set to the timer. Also delays turning OFF the HIGH and LOW outputs for the timer time. Timer time setting range: 1 to 5000 ms (default value: 1)	
	1 shot [1SHOT]	When the judgment result changes to PASS, outputs the PASS output for the time set to the timer. Neither the HIGH nor the LOW output is output. Timer time setting range: 1 to 5000 ms (default value: 1)	

As an example, here is an explanation of the procedure for setting the timer type to "1 shot" and the timer time to "10 ms".

Operating procedure

Steps	Key operation	Display	Description
1 - 3	For moving to JUDGE, see steps 1 to 3 in p.4-18		
4			Press ◀◀ or ▶▶ keys to select either of "TIMER" and press ZERO/SET key.
5			Select "1 shot" as the judgment output type. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "1SHOT" and press ZERO/SET key.
6			Set "10" as the timer duration. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀◀/▶▶ keys. Enter "10" and press ZERO/SET key.
7			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Settings for Binary Output

The following describes the settings for outputting the current measurement results and judgment values from the binary output of the 52-pole extended connector.

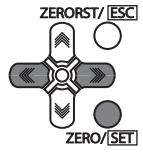
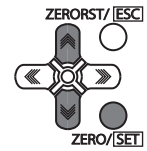
■ Output content setting

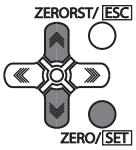
Sets the output content for binary output.

Setting [Display]		Description
Measurement value 1 [MEAS1]	TASK1 [TASK1]	Sets whether or not there is output for each task. The measured value for the task selected here is output as binary for each measurement cycle. (Default value TASK1: ON, TASK2 to 4: OFF)
	TASK2 [TASK2]	
	TASK3 [TASK3]	
	TASK4 [TASK4]	
Measurement value 2 [MEAS2]		The measured value for the task selected with the BINARY_SEL input (See p.4-31) is output.
Judgment value [JUDGE]		Outputs the judgment result.
Off [OFF] (Default value)		No binary output.

As an example, here is an explanation of the procedure for outputting the measured value of TASK1 as binary for each measuring cycle.

Operating procedure

Steps	Key operation	Display	Description
1			Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2			Press ◀◀ or ▶▶ keys to select either of "I/O" and press ZERO/SET key.
3			Press ◀◀ or ▶▶ keys to select either of "BINARY" and press ZERO/SET key.
4			Press ◀◀ or ▶▶ keys to select either of "OUTPUT" and press ZERO/SET key.
5			As the binary output contents, select "Measurement value 1". The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "MEAS1" and press ZERO/SET key.

Steps	Key operation	Display	Description
6			Press ≪ or ≫ keys to select either of "TASK1" and press ZERO/SET key.
7			Enable TASK1 binary output. The current setting value is displayed on the sub-display. Press ∧ / ∨ keys to enter the editing mode, and the sub-display blinks. Select "ON" and press ZERO/SET key.
8			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Output format

● **When the measured value is output**

Outputs the measured value as a 21-bit binary number (2's complement).

(Example1)

When the measured value is "+1.23456" (The number of digits after the decimal point is the default (5 digits).)

123456 (decimal) → 000011110001001000000 (binary)

(Example2)

When the measured value is "-1.23456"

-123456 (decimal) → 111100001110111000000 (binary)

CHECK! When multiple tasks are output continuously, the currently output task number is output in the BINARY_OUT output.

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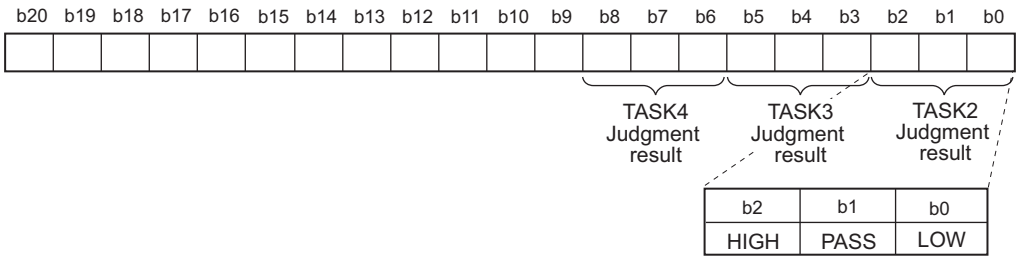
● **When the judgment is output**



Bit	Item	Details
b0/3/6	HIGH	Turns ON when the judgment result is HIGH.
b1/4/7	PASS	Turns ON when the judgment result is PASS.
b2/5/8	LOW	Turns ON when the judgment result is LOW.

■ Decimal point digit setting

Sets the number of digits after the decimal point for data output as binary.

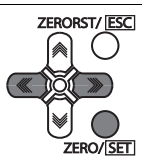
Setting [Display]	Description
Decimal point digit [DEC.NUM]	[0DIG]: 0 digit [1DIG]: 1 digit [2DIG]: 2 digits [3DIG]: 3 digits [4DIG]: 4 digits [5DIG]: 5 digits (Default value) [6DIG]: 6 digits

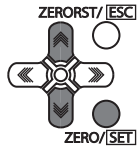
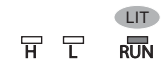
Example:
If the measured value is "0.123456", the output value is as follows according to the number of digits after the decimal point.
0 digits: 0 (output range: 1048576 mm - 1048575 mm)
1 digit: 1 (output range: 104857.6 mm - 104857.5 mm)
2 digits: 12 (output range: 10485.76 mm - 10485.75 mm)
3 digits: 123 (output range: 1048.576 mm - 1048.575 mm)
4 digits: 1234 (output range: 104.8576 mm - 104.8575 mm)
5 digits: 12345 (output range: 10.48576 mm - 10.48575 mm)
6 digits: 123456 (output range: 1.048576 mm - 1.048575 mm)

If the measurement result is outside the output range, the output range upper or lower limit is output.
For example, if the number of digits after the decimal point is 6 and the measurement result is 2.00000 mm,
the binary output value is 1048575.
If there is a measurement abnormality, the output range upper limit value is output.

As an example, here is an explanation of the procedure for setting the number of digits after the decimal point to "3".

Operating procedure

Steps	Key operation	Display	Description
1 - 3	For moving to BINARY, see steps 1 to 3 in p.4-22		
4			Press ≪ or ≫ keys to select either of "DEC.NUM" and press ZERO/SET key.

Steps	Key operation	Display	Description
5			Select "3" as the number of digits after the decimal point. The current setting value is displayed on the sub-display. Press ∧ / ∨ keys to enter the editing mode, and the sub-display blinks. Select "3DIG" and press ZERO/SET key.
6			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

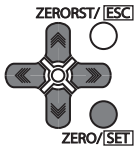
■ Output cycle setting

Sets the output cycle for binary output.
The output cycle can be set as an integer multiple of the measurement cycle.

Setting [Display]	Description
Output cycle [CYCLE]	The binary data is output at the interval "setting value x measurement cycle". Range: 1 to 100 (Default value: 1)

As an example, here is an explanation of the procedure for setting the output cycle to "2 times" the measurement cycle.

Operating procedure

Steps	Key operation	Display	Description
1 - 3	For moving to BINARY, see steps 1 to 3 in p.4-22		
4			Press ≪ or ≫ keys to select either of "CYCLE" and press ZERO/SET key.
5			Set "2" as the output cycle. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ∧ / ∨ / ≪ / ≫ keys. Enter "2" and press ZERO/SET key.
6			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

CHECK! The measuring cycle can be viewed in the "System Information" menu.

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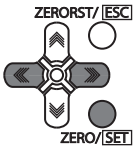
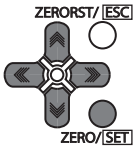
■ GATE signal setting

Sets the output time for the synchronization signal (GATE) for taking in signals externally.

Setting [Display]	Description
GATE period [GATE]	The GATE signal is output for the set time.

As an example, here is an explanation of the procedure for setting the output time to "100 ms".

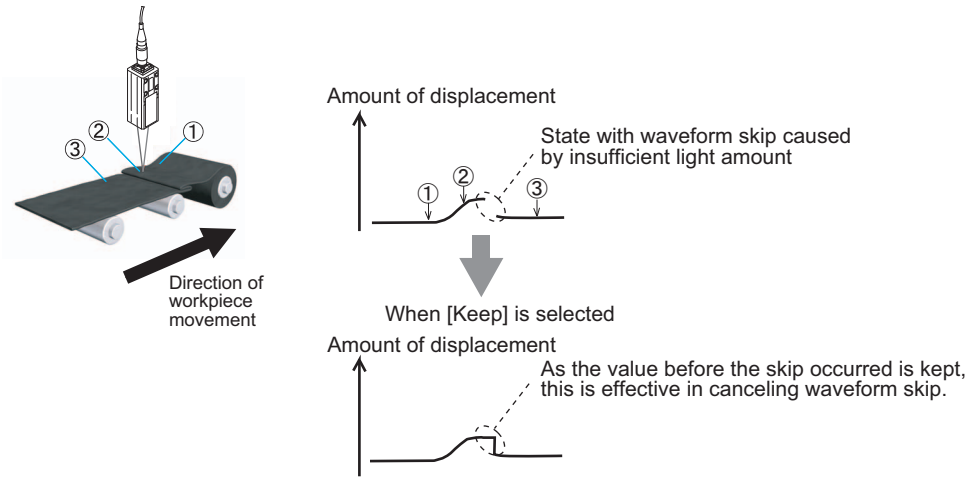
Operating procedure

Steps	Key operation	Display	Description
1 - 3	For moving to BINARY, see steps 1 to 3 in p.4-22		
4			Press ◀◀ or ▶▶ keys to select either of "GATE" and press ZERO/SET key.
5			Set "100" as the output time. The current setting value is displayed on the sub-display. Press ZERO/SET key to enter the editing mode, and the sub-display blinks. To edit numerical values use ▲/▼/◀◀/▶▶ keys. Enter "100" and press ZERO/SET key.
6			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Settings for Processing when Measurement Cannot be Performed

Set the output methods for linear, judge, and terminal block when a non-measurement state occurs temporarily due to insufficient received light amount or the reset input state, for example.

Example: When the waveform skips due to insufficient received light amount cycle



Setting [Display]	Outputs	
	Analog output/Binary output	Judgment Output
Keep [KEEP]	The status immediately before measurement is stopped is held and output.	
Clamp [CLAMP] (Default value)	Outputs the set Clamp value (abnormal value).	All OFF

CHECK!

In hold measurement, the output before the first hold value is obtained will be the same as [Clamp] even if [Keep] is set.

As an example, here is an explanation of the procedure for setting the processing for when measurement is not possible to "Clamp".

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	I/O	Press ≪ or ≫ keys to select either of "I/O" and press ZERO/SET key.
3		HLd.RSt	Press ≪ or ≫ keys to select either of "HLD.RST" and press ZERO/SET key.
4	ZERORST/ESC, ZERO/SET	HLd.RSt CLAMP	Select "Clamp" as the processing for when measurement is not possible. The current setting value is displayed on the sub-display. Press ∧/∨ keys to enter the editing mode, and the sub-display blinks. Select "CLAMP" and press ZERO/SET key.

■ Setting the clamp value

If [Clamp] is selected for the processing when measurement cannot be performed, set the clamp value to be output.

• For analog output

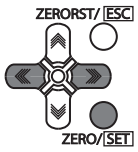
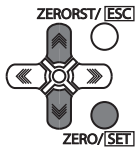
Output	Setting
When current is output	MIN (approximately 3.4 mA)/ 4 to 20mA (every 1 mA)/ MAX (approximately 21 mA), (Default value: MAX)
When voltage is output	MIN (approximately -10.8 v)/ -10 to 10 V (every 1 V)/ MAX (approximately 10.8 V), (Default value: MAX)

• For binary output

Setting
MIN (-1048576) MAX (1048575) (Default value)

As an example, here is an explanation of the procedure for setting the clamp value to "analog voltage output 10 V".

Operating procedure

Steps	Key operation	Display	Description
1 - 4	For moving to HLD.RST - CLAMP, see steps 1 to 4 in p.4-29		
5			Press ◀ or ▶ keys to select either of "ANALOG" and press ZERO/SET key.
6			Set the clamp value. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select "10V" and press ZERO/SET key.
7			Press RUN/FUN/L-TEACH key for two seconds to enter the RUN mode.

Settings for I/O Signals

This section describes the settings for controlling by using external I/O signals.

■ Binary output object task selection input

The task output as binary is selected in combinations of the binary output object task selection input signals (BINARY_SEL1 and 2).

Binary output object task selection input 1 (BINARY_SEL1)	Binary output object task selection input 2 (BINARY_SEL2)	Selected task
OFF	OFF	TASK1
ON	OFF	TASK2
OFF	ON	TASK3
ON	ON	TASK4

■ Binary output task number outputs

The task number currently output as binary is output.
The output task number is according to the combination of the binary output task number outputs (BINARY_OUT1 and 2).

Binary output task number output 1 (BINARY_OUT1)	Binary output task number output 2 (BINARY_OUT2)	Output task
OFF	OFF	TASK1
ON	OFF	TASK2
OFF	ON	TASK3
ON	ON	TASK4

■ Bank select input

The bank is selected in combinations of the bank select input signals (BANK_SEL1 to 3).

Bank select input 1 (BANK_SEL1)	Bank select input 2 (BANK_SEL2)	Bank select input 3 (BANK_SEL3)	Selected bank
OFF	OFF	OFF	BANK1
ON	OFF	OFF	BANK2
OFF	ON	OFF	BANK3
ON	ON	OFF	BANK4
OFF	OFF	ON	BANK5
ON	OFF	ON	BANK6
OFF	ON	ON	BANK7
ON	ON	ON	BANK8

- Bank switching is begun 0.2 seconds after the input state changes.
- At most it takes about 100 ms to switch banks.
- During bank switching the BUSY output becomes ON.
- If the bank mode is set to "Judgment value [JUDGE]", the bank cannot be switched at the external signal input because the number of banks increases to 32.

■ Bank number output

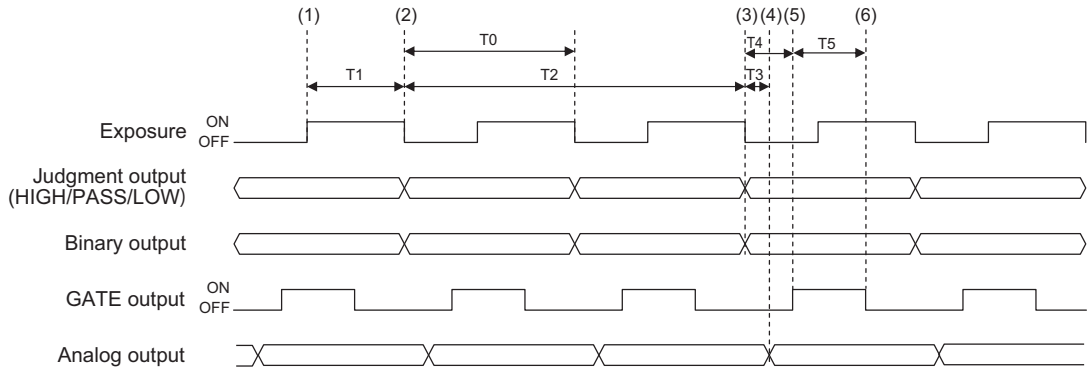
The currently selected bank number is output. The output bank number is according to the combination of the bank number output signals (BANK_OUT1 to 3).

Bank number output 1 (BANK_OUT1)	Bank number output 2 (BANK_OUT2)	Bank number output 3 (BANK_OUT3)	Output bank
OFF	OFF	OFF	BANK1
ON	OFF	OFF	BANK2
OFF	ON	OFF	BANK3
ON	ON	OFF	BANK4
OFF	OFF	ON	BANK5
ON	OFF	ON	BANK6
OFF	ON	ON	BANK7
ON	ON	ON	BANK8

Timing Charts

The following shows the timing charts when communication is performed with external devices.

■ Basic operation

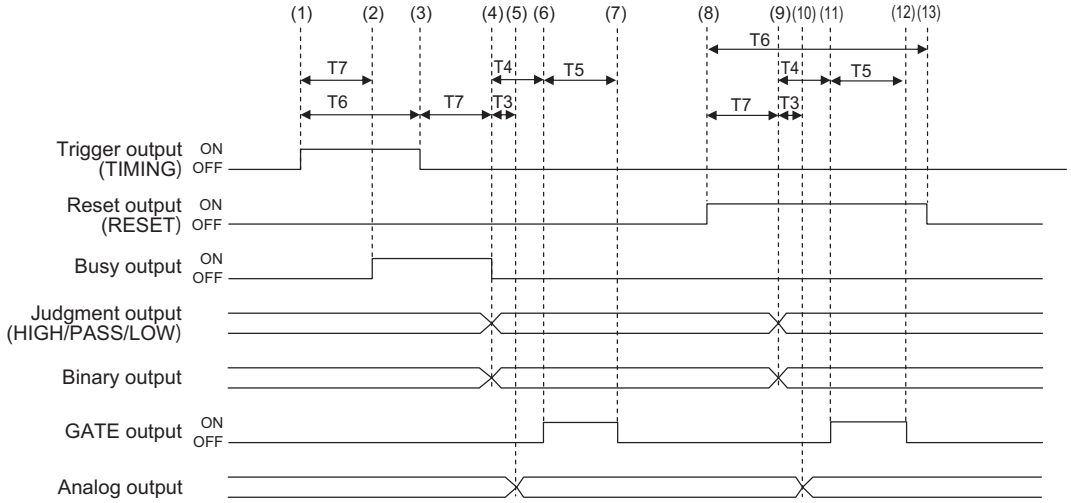


Item		Minimum	Maximum
T0	Measurement cycle	0.5 ms	Depends on the set conditions (0.5 to 30 ms)
T1	Exposure time	1 μs	Maximum exposure time (1 to 5000 μs)
T2	Response time of output	T0×2	T0×2
T3	Response time of analog output	-	0.1 ms
T4	GATE signal rise time	-	0.2 ms
T5	Output time of GATE signal	Setting value (0.1 to 100.0 ms)	Setting value (0.1 to 100.0 ms)

● Explanation of operations

(1) During each sampling cycle, the LEDs are lit up and exposure is started.
(2) After the end of exposure, measurement starts.
(3) After the end of measurement, the judgment results and binary data are output.
(4) After the judgment results and binary data are output, the analog output is updated.
(5) After the judgment results and binary data are output, the GATE signal is turned ON.
(6) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.

■ Peak/Bottom/Peak to peak/Average hold



Item		Minimum	Maximum
T3	Response time of analog output	-	0.1 ms
T4	GATE signal rise time	-	0.2 ms
T5	Output time of GATE signal	Setting value (0.1 to 100.0 ms)	Setting value (0.1 to 100.0 ms)
T6	Trigger input/reset input minimum time‘	3 ms+T0	-
T7	Response time of input	2 ms+T0	3 ms+T0×2

● **Explanation of operations**

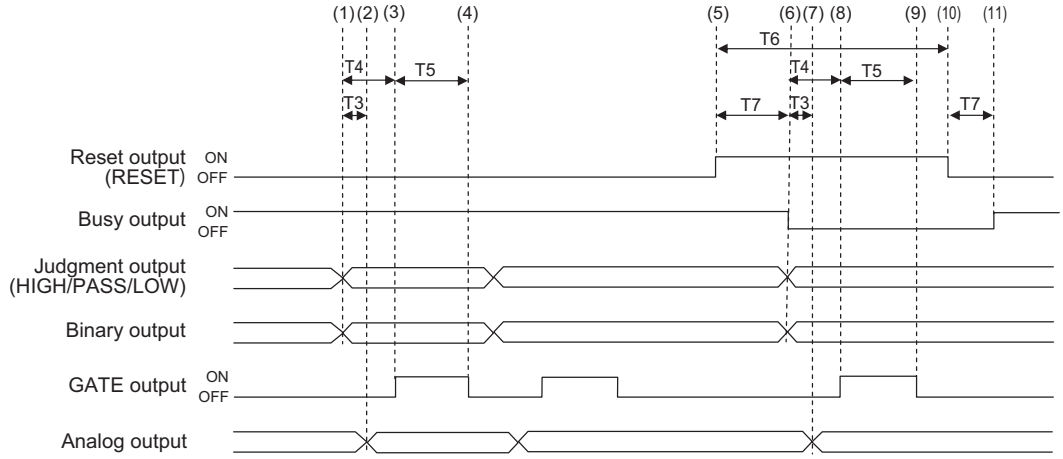
(1) The trigger signal is turned ON.
(2) During the trigger input minimum time, when the trigger is input is ON, sampling is started and the BUSY signal is turned ON.
(3) After the end of measurement, the judgment results and binary data are output.
(4) After the trigger signal goes OFF, sampling is ended and the judgment results and binary data are output. The BUSY signal is also turned OFF.
(5) After the judgment result and binary data output, the analog output is updated.
(6) After the judgment result and binary data output, the GATE signal is turned ON.
(7) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(8) The reset signal is turned ON. During the reset input minimum time, if the reset signal is turned ON, the measured value is reset.
(9) The judgment results and binary data are reset.
(10) After the judgment results and binary data are reset, the analog output is reset.
(11) After the judgment results and binary data are reset, the GATE signal is turned ON.
(12) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(13) The reset signal is turned OFF.

(Caution)
When the setting for non-measurement is "Clamp", if the sampling value is an abnormal value or an undetermined value *, sampling is not executed. If sampling has been started, it is stopped. The output value is as follows.
- The clamp value is held.
- If the previous hold value is not the clamp value, the GATE signal is output.

To start and continue sampling even if a sampling value is an abnormal value or an undetermined value, set "Keep" as the non-measurement setting.

* After the start of measurement, if measurement results are not obtained the number of times required to take the average, the measurement result is not applied.

■ Auto peak/Auto bottom/Auto peak to peak hold



Item		Minimum	Maximum
T3	Response time of analog output	-	0.1 ms
T4	GATE signal rise time	-	0.2 ms
T5	Output time of GATE signal	Setting value (0.1 to 100.0 ms)	Setting value (0.1 to 100.0 ms)
T6	Trigger input/reset input minimum time‘	3 ms+T0	-
T7	Response time of input	2 ms+T0	3 ms+T0×2

● **Explanation of operations**

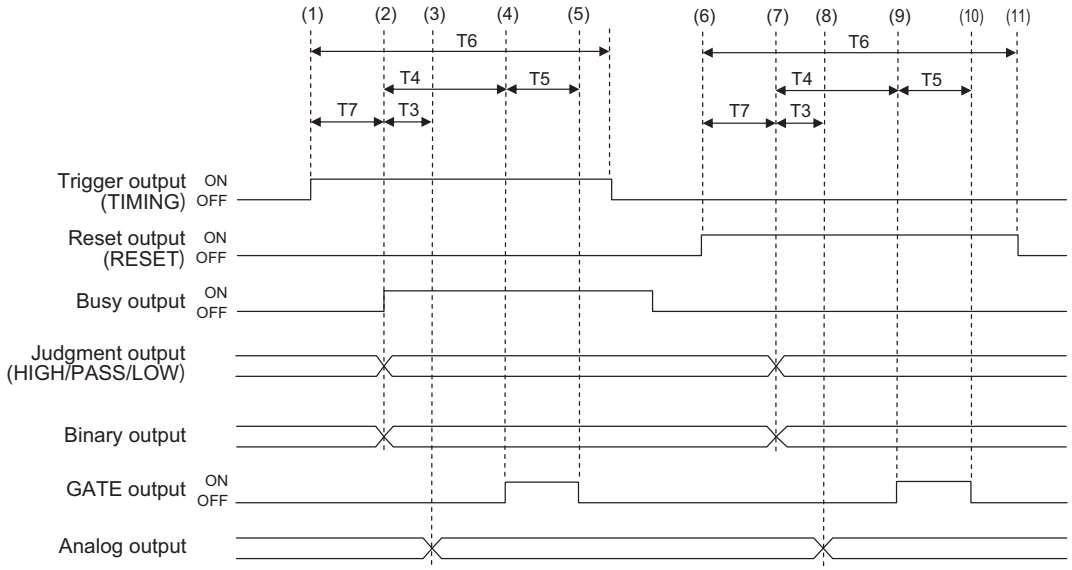
(1) The peak value is updated and the judgment results and binary data are output.
(2) After the judgment result and binary data output, the analog output is updated.
(3) After the judgment result and binary data output, the GATE signal is turned ON.
(4) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(5) The reset signal is turned ON. During the reset input minimum time, if the reset signal is turned ON, the measured value is reset.
(6) The judgment results and binary data are reset. The BUSY signal is turned OFF.
(7) After the judgment results and binary data are reset, the analog output is reset.
(8) After the judgment result and binary data output, the GATE signal is turned ON.
(9) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(10) The reset signal is turned OFF.
(11) The BUSY signal is turned ON.

(Caution)
When the setting for non-measurement is "Clamp", if the sampling value is an abnormal value or an undetermined value *, sampling is not executed. If sampling has been started, it is stopped. The output value is as follows.
- The clamp value is held.
- If the previous hold value is not the clamp value, the GATE signal is output.
- The BUSY signal is turned OFF.

To start and continue sampling even if a sampling value is an abnormal value or an undetermined value, set "Keep" as the non-measurement setting.

* After the start of measurement, if measurement results are not obtained the number of times required to take the average, the measurement result is not applied.

■ Sample hold



Item		Minimum	Maximum
T3	Response time of analog output	-	0.1 ms
T4	GATE signal rise time	-	0.2 ms
T5	Output time of GATE signal	Setting value (0.1 to 100.0 ms)	Setting value (0.1 to 100.0 ms)
T6	Trigger input/reset input minimum time‘	3 ms+T0	-
T7	Response time of input	2 ms+T0	3 ms+T0×2

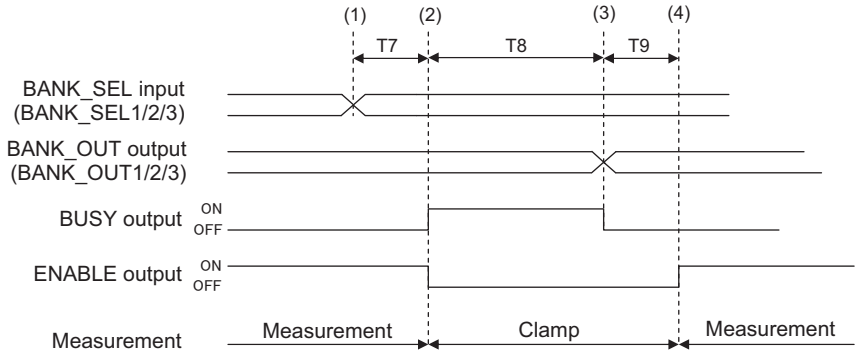
● Explanation of operations

(1) The trigger signal is turned ON.
(2) During the trigger input minimum time, when the trigger is input is ON, sampling is started and the BUSY signal is turned ON. The measurement results are sampled and the judgment results and binary data are output.
(3) After the judgment result and binary data output, the analog output is updated.
(4) After the judgment result and binary data output, the GATE signal is turned ON.
(5) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(6) The reset signal is turned ON. During the reset input minimum time, if the reset signal is turned ON, the measured value is reset.
(7) The judgment results and binary data are reset.
(8) After the judgment result and binary data output, the analog output is reset.
(9) After the judgment result and binary data output, the GATE signal is turned ON.
(10) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(11) The reset signal is turned OFF.

(Caution)
When the setting for non-measurement is "Clamp", if the sampling value is an abnormal value or an undetermined value *, sampling is not executed. The output value is as follows.
- The clamp value is held.
- If the previous hold value is not the clamp value, the GATE signal is output.
- The BUSY signal is not turned ON.

* After the start of measurement, if measurement results are not obtained the number of times required to take the average, the measurement result is not applied.

■ Bank switching



Item		Minimum	Maximum
T7	Response time of input	-	200 ms
T8	Bank switching time	-	100 ms
T9	Measurement start response time	3×T0	Depends on the set conditions

● Explanation of operations

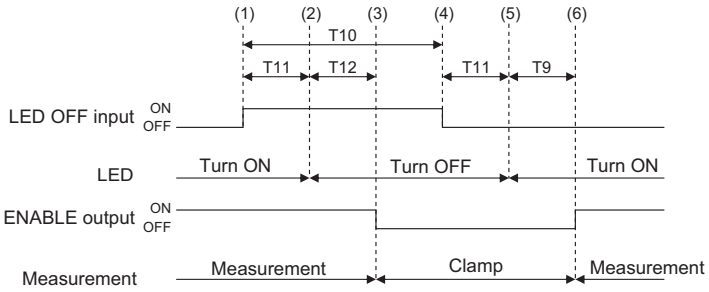
(1) The BANK_SEL signal is switched to the bank number switched to.

(2) After the input response time, the measurement stops and the BUSY signal is turned ON, then the bank switching operation is started.

(3) After the bank switching ends, the BUSY signal is turned OFF and the BANK_OUT signal is switched.

(4) After the bank switching ends, the BUSY signal is turned OFF and the BANK_OUT signal is switched.

■ LED OFF

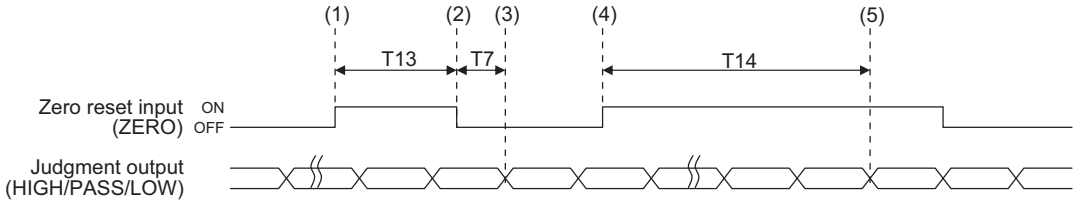


Item		Minimum	Maximum
T9	Measurement start response time	3×T0	Depends on the set conditions
T10	Time of receiving LED OFF input	100 μs	-
T11	Response time of LED OFF	-	100 μs
T12	ENABLE response time after LEDs are turned OFF	-	2×T0

● Explanation of operations

(1) The LED OFF signal is turned ON.
(2) After the LED OFF signal is turned ON, the LEDs are turned OFF.
(3) After the LEDs are turned OFF, the ENABLE signal is turned OFF.
(4) The LED OFF signal is turned OFF.
(5) After the LED OFF signal is turned OFF, the LEDs are turned ON.
(6) After the LEDs are lit up, measurement is restarted and the ENABLE signal is turned ON.

■ Zero reset

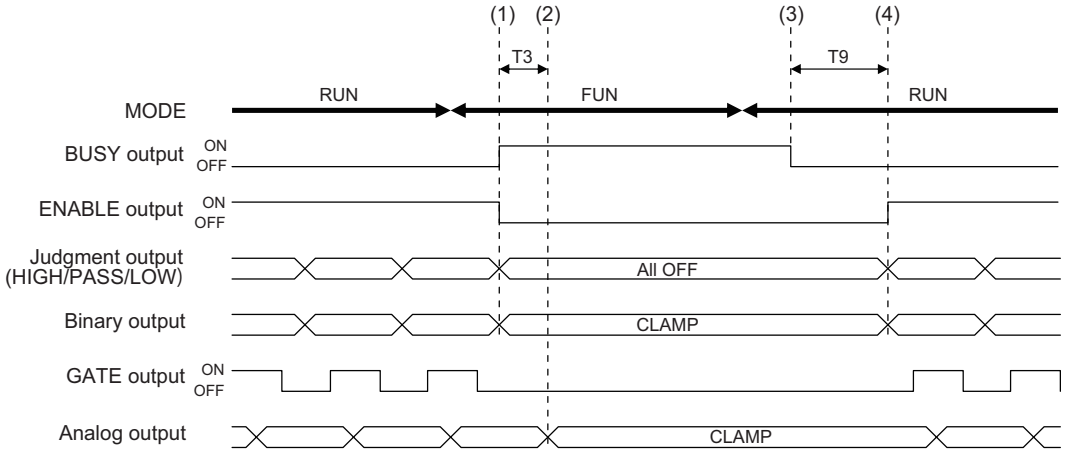


Item		Minimum	Maximum
T7	Response time of input	2 ms+T0	3 ms+T0×2
T13	Zero reset input time	50 ms	0.8 s
T14	Cancel time of zero reset input	1 s	-

● **Explanation of operations**

(1) The zero reset input is turned ON.
(2) After the zero reset input time, the zero reset input is turned OFF.
(3) After the zero reset input is turned OFF, the zero reset is executed and the judgment results reflected in the measurement results are output.
(4) The zero reset input is turned ON.
(5) After at least the cancel time of zero reset input has passed, the zero reset is cancelled.

■ Operating mode switching



Item		Minimum	Maximum
T3	Response time of analog output	-	0.1 ms
T9	Measurement start response time	3×T0	Depends on the set conditions

CHECK!

In FUN mode, there is no binary output. Immediately after the mode is switched to RUN mode, the clamp value is output until the measured value is applied.

● Explanation of operations

(1) After the mode is switched from RUN to FUN mode, the BUSY output and ENABLE output are turned OFF. The judgment outputs all go OFF and the binary output is output clamped.

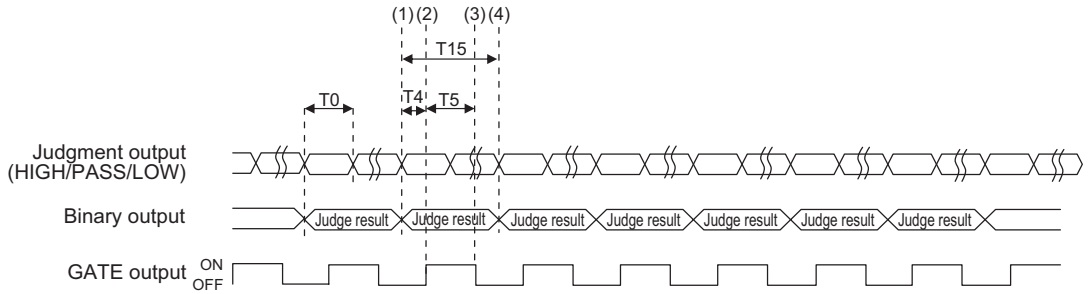
(2) The response time of analog output after the BUSY output is turned ON, the analog output is output clamped.

(3) After the mode is switched from FUN mode to RUN mode, the BUSY output is turned OFF.

(4) Measurement is restarted and the ENABLE signal is turned ON, then the measurement results are output.

■ Binary output

● **When the judgment results for all tasks are output at the same time (judgment value mode (When the output target is a judgment value)**
The binary output results can be acquired when the GATE output is ON.



Item		Minimum	Maximum
T0	Measurement cycle	0.5 ms	Depends on the set conditions
T4	GATE signal rise time	-	0.2 ms
T5	Output time of GATE signal	Setting value (0.1 to 100.0 ms)	Setting value (0.1 to 100.0 ms)
T15	Binary output update cycle	T0×Update cycle	T0×Update cycle

• Explanation of operations

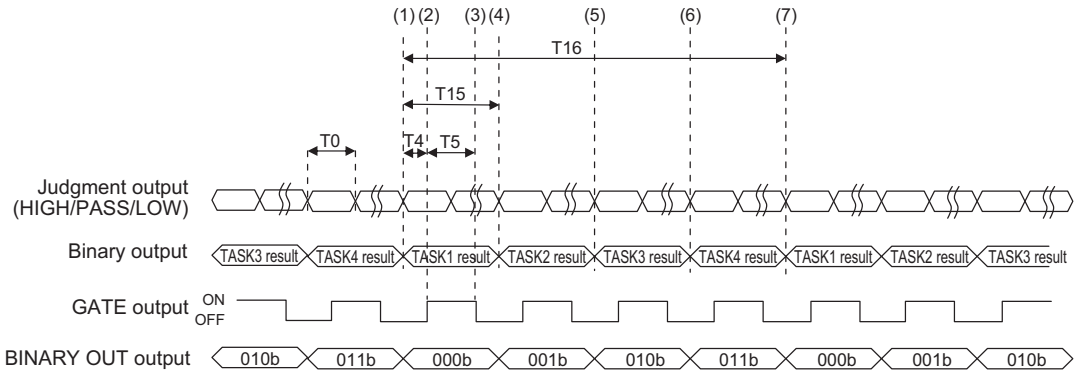
(1) The TASK2, 3 and 4 judgment results (HIGH/PASS/LOW) are output.
(2) After the judgment result output, the GATE signal is turned ON.
(3) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(4) After the binary output update cycle, the TASK2, 3 and 4 judgment results are updated.

■ Task measurement result output

The following two output methods can be selected from.

- Measured value 1 mode (When measured values for multiple tasks are output consecutively)
  The preset tasks are output in order for each of a certain cycle.
- Measured value 2 mode (When measured values for multiple tasks are output by BINARY_SEL input)
  The tasks to output with binary output are selected with external input and the measurement data for those tasks is output.

● Measured value 1 mode (When measured values for multiple tasks are output consecutively)



Item		Minimum	Maximum
T0	Measurement cycle	0.5 ms	Depends on the set conditions (0.5 to 30 ms)
T4	GATE signal rise time	-	0.2 ms
T5	Output time of GATE signal	Setting value (0.1 to 100.0 ms)	Setting value (0.1 to 100.0 ms)
T15	Binary output update cycle	T0×Update cycle	T0×Update cycle
T16	Binary output update cycle 2	T0×Update cycle×number of tasks output	T0×Update cycle×number of tasks output

- Explanation of operations (When the results for all tasks are output)

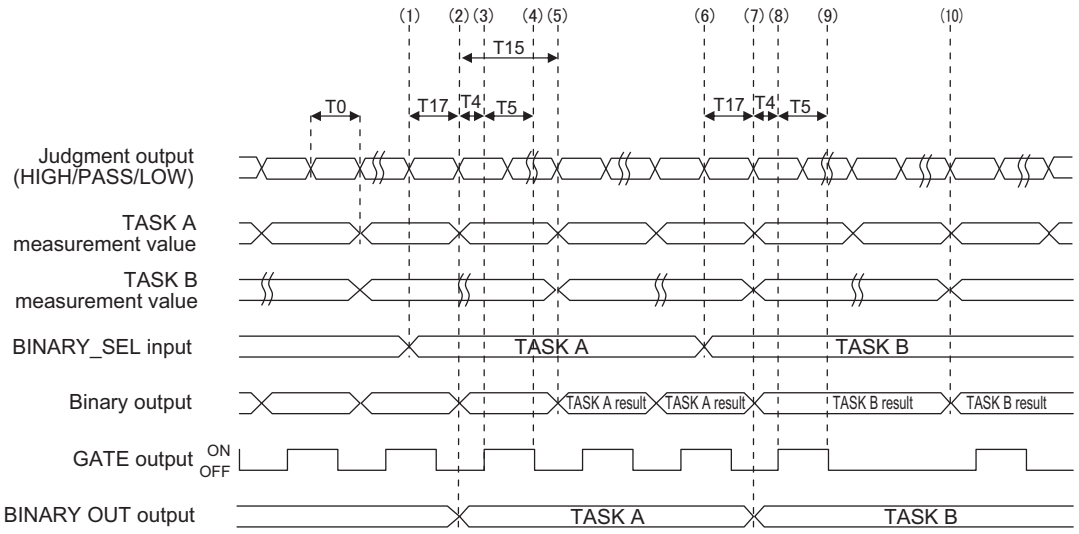
(1) The TASK1 results are output (judgment output and binary output).
(2) After the judgment result and binary data output, the GATE signal is turned ON.
(3) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(4) After the binary output update cycle, the TASK2 results are output (judgment output and binary output).
(5) After the binary output update cycle, the TASK3 results are output (judgment output and binary output).

(6) After the binary output update cycle, the TASK4 results are output (judgment output and binary output).
(7) After binary output update cycle 2, the TASK1 results are output (judgment output and binary output).

Which tasks to output results for can be selected.

Binary output object task selection input p.4-10

● Measured value 2 mode (When measured values for multiple tasks are output by BINARY_SEL input)



Item		Minimum	Maximum
T0	Measurement cycle	0.5 ms	Depends on the set conditions
T4	GATE signal rise time	-	0.2 ms
T5	Output time of GATE signal	Setting value (0.1 to 100.0 ms)	Setting value (0.1 to 100.0 ms)
T15	Binary output update cycle	T0×Update cycle	T0×Update cycle
T17	Response time of input	-	T0

• Explanation of operations (When the results for all tasks are output)

(1) Input the number of the task you want to output to the BINARY_SEL input.
(2) The results for the selected tasks are output (judgment output and binary output).
(3) After the judgment result and binary data output, the GATE signal is turned ON.
(4) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(5) When the results for the selected tasks are updated, the judgment output and binary output are also updated.
(6) Input the number of the task you want to output to the BINARY_SEL input.
(7) The results for the selected tasks are output (judgment output and binary output).
(8) After the judgment result and binary data output, the GATE signal is turned ON.
(9) The GATE output time after the GATE signal is turned ON, the GATE signal is turned OFF.
(10) When the results for the selected tasks are updated, the judgment output and binary output are also updated.

Chapter 5
Ethernet/RS-232C COMMUNICATION

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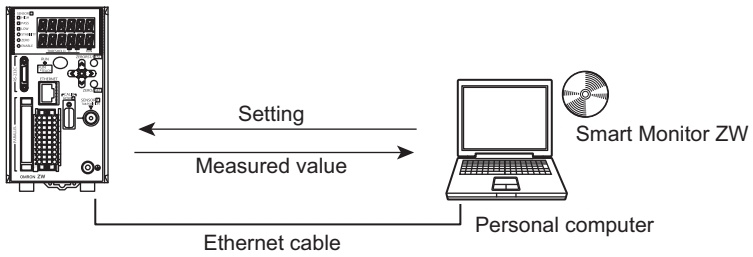
Overview

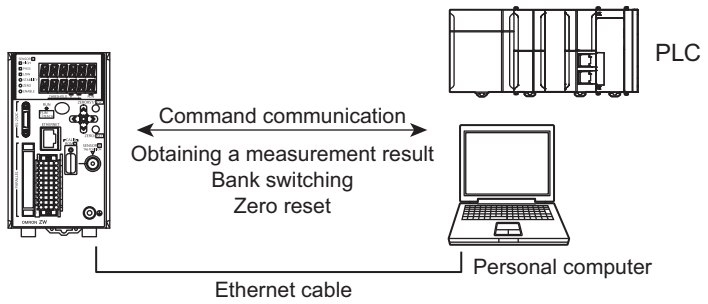
Using the Ethernet connector or RS-232C connector of the Controller, you can communicate digitally with external devices such as a personal computer or programmable controller. Compared to linear output, you can obtain high resolution, highly stable measurement data.
Communication with external devices using Ethernet or RS-232C is performed in RUN or TEACH mode. Communication cannot be performed in FUN mode. Also, when a system error occurs, the Sensor Controller receives a command externally, but does not execute the setting commands.

Ethernet Communication

The Controller can be connected to a personal computer, and the settings can be changed from the personal computer using Smart Monitor ZW. In addition, the measurement can be monitored on the personal computer



Also, communication can be performed using non-procedural commands.

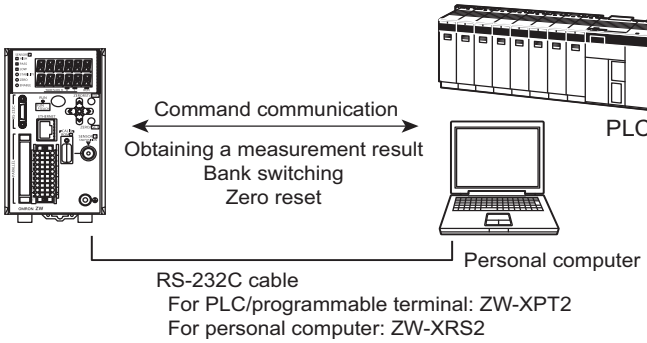


Connecting Using Ethernet Cable p.5-5

Important
Communication with multiple devices simultaneously cannot be achieved via Ethernet.
For example, when a personal computer and the PLC are connected to the controller via Ethernet, the communication established between the PLC and the controller needs to be disconnected before a communication with the controller is to be established with the personal computer using Smart Monitor ZW.

RS-232C Communication

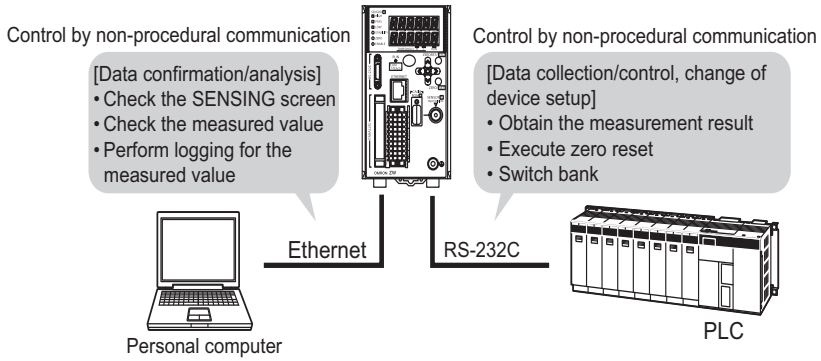
Connections to the programmable controller, programmable terminal, and personal computer can be made.
Communication can be performed using non-procedural commands.



Connecting Using RS-232C Cable p.5-7

CHECK!

Two lines from the Ethernet connector and RS-232C connector can be used together for communication. For example, “data confirmation/analysis” and “data collection/control, change of device setup” can be performed simultaneously.



Note that there are restrictions as described below for communication in which two lines are used together.

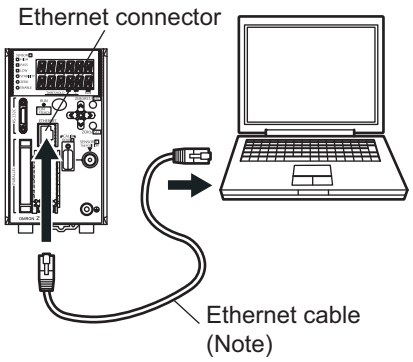
- The command entered first becomes valid, and the command entered next is executed after processing of the first command ends.

Connecting Using Ethernet Cable

Connection Method

1. Insert one end of the Ethernet cable into the Ethernet connector of the controller.

2. Insert another end of the Ethernet cable into the Ethernet connector of the external device.



(Note)
Prepare commercially available Ethernet cable satisfying the following requirements:
-Category 5e or more, 30 m or less
-RJ45 connector (8-pin modular jack)
-For direct connection: Select cross cable.
-For connection through a network hub: Select straight cable.

Communication Settings

Set the Ethernet communication of the controller.
Set the IP address and subnet mask.
Set a three-digit value for each setting as shown below.

Setting [Display]	Description
IP address [IPADDR]	IP1.IP2.IP3.IP4 IP1 : 1 to 223 (default value: 192) IP2 : 0 to 255 (default value: 168) IP3 : 0 to 255 (default value: 250) IP4 : 1 to 254 (default value: 50)
Subnet mask [SUBNET]	SUB1.SUB2.SUB3.SUB4 SUB1 : 0 to 255 (default value: 255) SUB2 : 0 to 255 (default value: 255) SUB3 : 0 to 255 (default value: 255) SUB4 : 0 to 255 (default value: 0)

Operating procedure

Steps	Key operation	Display	Description
1	RUN / FUN / TEACH	UNLIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the FUN mode.
2	ZERORST/ESC, ZERO/SET	SYSTEM	Press ◀ or ▶ keys to select either of "SYSTEM" and press ZERO/SET key.
3		COM	Press ◀ or ▶ keys to select either of "COM" and press ZERO/SET key.
4		ETN	Press ◀ or ▶ keys to select either of "ETN" and press ZERO/SET key.
5		IPADDR	Press ◀ or ▶ keys to select either of "IPADDR" and press ZERO/SET key.
6		IP1	Press ◀ or ▶ keys to select either of "IP1" and press ZERO/SET key.
7	ZERORST/ESC, ZERO/SET	IP1 192	Set the IP1 value. The current setting value is displayed on the sub-display. Press ▲ / ▼ / ◀ / ▶ keys to enter the editing mode, and the sub-display blinks. Enter the IP1 value and then press ZERO/SET key.
8	ZERORST/ESC	IP1	Press ZERORST/ESC key to return to the previous menu.
9	Repeat steps 6 to 8 to enter the "IP2," "IP3," and "IP4" setting values.		
10	ZERORST/ESC	IPADDR	Press ZERORST/ESC key twice to return to the menu before last.
11	ZERORST/ESC, ZERO/SET	SUBNET	Press ◀ or ▶ keys to select either of "SUBNET" and press ZERO/SET key.
12	Perform the same steps to set the subnet mask.		
13	RUN / FUN / TEACH	LIT H L RUN	Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

CHECK!

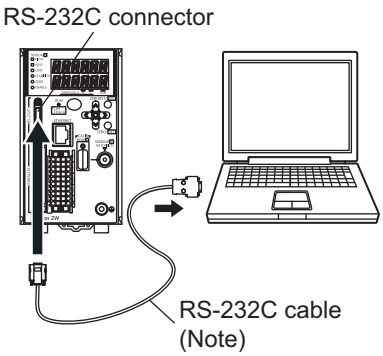
- The settings becomes effective after a reboot.
- For the setting on Smart Monitor ZW (personal computer), refer to "Settings when Connecting Personal Computer with Controller" (p.1-25)

Connecting Using RS-232C Cable

Connection Method

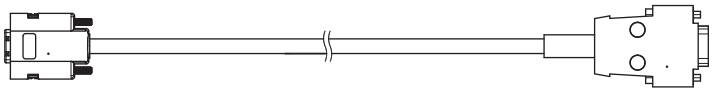
1. **Insert one end of the RS-232C cable (square 17-pin side) into the RS-232C connector of the controller**

2. **Insert another end of the RS-232C cable (D-SUB 9-pin side) into the Ethernet connector of the external device.**



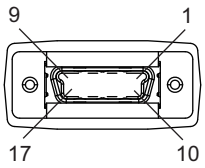
(Note)
Use the following exclusive products for RS-232C cable.
- When connecting to the PLC or programmable terminal: ZW-XPT2 (see p.5-8)
- When connecting to a personal computer: ZW-XRS2 (see p.5-9)

■ RS-232C cable (For PLC/programmable terminal)
ZW-XPT2 (Cable length: 2 m)

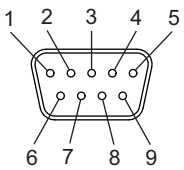


Controller side

PLC/Programmable terminal side



Square 17-pin side



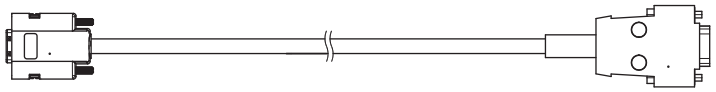
D-SUB 9-pin side

Signal name	Pin No.
GND(0V)	1
TXD(SD)	2
RXD(RD)	3
RTS(RS)	4
CTS(CS)	5
NC	6
NC	7
NC	8
NC	9
NC	10
NC	11
NC	12
NC	13
NC	14
NC	15
NC	16
NC	17
FG	SHELL

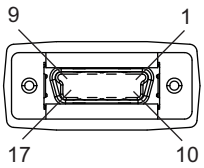
Pin No.	Signal name
1	NC
2	TXD(SD)
3	RXD(RD)
4	RTS(RS)
5	CTS(CS)
6	NC
7	NC
8	NC
9	GND(0V)
SHELL	FG

Plug-type connector

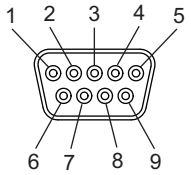
■ RS-232C cable (For personal computer)
ZW-XRS2 (Cable length: 2 m)



Controller side　　Personal Computer side



Square 17-pin side



D-SUB 9-pin side

Signal name	Pin No.
GND(0V)	1
TXD(SD)	2
RXD(RD)	3
RTS(RS)	4
CTS(CS)	5
NC	6
NC	7
NC	8
NC	9
NC	10
NC	11
NC	12
NC	13
NC	14
NC	15
NC	16
NC	17
FG	SHELL

Pin No.	Signal name
1	NC
2	RXD(RD)
3	TXD(SD)
4	NC
5	GND(0V)
6	NC
7	RTS(RS)
8	CTS(CS)
9	NC
SHELL	FG

Socket-type connector

Communication Settings

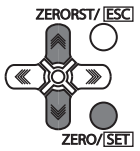
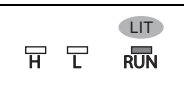
Set the communication specifications for the controller according to the communication specifications for external devices.

Setting [Display]	Description
Data length [DATA]	8 bit [8BIT]/7 bit [7BIT] (default value: 8 bit)
Parity [PARITY]	None [OFF]/ODD[ODD]/EVEN[EVEN] (default value: None)
Stop bit [STOP]	1 bit [1BIT]/2 bit [2BIT] (default value: 1 bit)
Baud Rate [BAUD.RT]	9600/19200/38400/57600/115200 (default value: 38400)
CS/RS [CS/RS]	OFF/ON (default value: OFF)j

Communication cannot be established with the ZW series in the following condition.

• Data length: 7-bit and Parity: None

Operating procedure

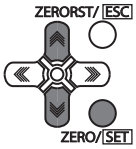
Steps	Key operation	Display	Description
1 - 3	For moving to COM, see steps 1 to 3 in p.5-6		
4			Press ◀◀ or ▶▶ keys to select either of "RS232C" and press ZERO/SET key.
5			Press ◀◀ or ▶▶ keys to select either of "DATA" and press ZERO/SET key.
6			Select the data length. The current setting value is displayed on the sub-display. Press ▲/▼ keys to enter the editing mode, and the sub-display blinks. Select the data length and press ZERO/SET key.
7			Press ZERORST/ESC key to return to the previous menu.
8			Press ◀◀ or ▶▶ keys to select either of "PATITY" and press ZERO/SET key.
9	Repeat steps 6 to 8 to set other items.		
10			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

■ Setting the delimiter

Set the delimiter for RS-232C communication.

Setting [Display]	Description
CR [CR] (default value)	delimiter: CR
LF [LF]	delimiter: LF
CR+LF [CRLF]	delimiter: CR+LF

Operating procedure

Steps	Key operation	Display	Description
1 - 3	For moving to COM, see steps 1 to 3 in p.5-6		
4			Press ≪ or ≫ keys to select either of "DATA" and press ZERO/SET key.
5			Select the delimiter. The current setting value is displayed on the sub-display. Press ∧ / ∨ keys to enter the editing mode, and the sub-display blinks. Select the delimiter and press ZERO/SET key.
6			Press RUN/FUN/TEACH key for two seconds to enter the RUN mode.

Communication Command List

Command name	Format	Return value *1	Details	Refer
MS	MS <task number> <delimiter>	<measured value> <delimiter>	Acquires the current measured value. If the <task number> is omitted, the measured value displayed is acquired. If "4" is set for the <task number>, the measured values for all tasks are obtained.	p.5-14
JG	JG <task number> <delimiter>	<judgment result> <delimiter>	Acquires the judgment result of the specified task. If the <task number> is omitted, the result of the task of which the result is currently displayed is acquired. If "4" is set for the <task number>, the measured values for all tasks are obtained.	p.5-16
DG	DG <unit number> <data number> <delimiter>	<data> <delimiter>	Acquires the measurement data and setting data of the processing unit.	p.5-17
DS	DS <unit number> <data number> <setting value> <delimiter>	OK <delimiter>	Changes the setting data of the processing unit.	p.5-18
BG	BG <delimiter>	<bank number> <delimiter>	Acquires the current bank number.	p.5-19
BS	BS <data number> <delimiter>	OK <delimiter>	Replaces the current bank number by the specified bank number.	p.5-20
ZR	ZR <task number> <delimiter>	OK <delimiter>	Executes a zero reset for the specified task. If the <task number> is omitted, the zero reset is executed for the task of which the result is currently displayed. If "4" is set for the <task number>, this is executed for all tasks.	p.5-21
ZC	ZC <task number> <delimiter>	OK <delimiter>	Cancels the zero reset of the specified task. If the <task number> is omitted, the zero reset is executed for the task of which the result is currently displayed. If "4" is set for the <task number>, this is executed for all tasks.	p.5-22
TM	TM <0:OFF/ 1:ON> <0><delimiter>	OK <delimiter>	Executes the timing input. * Calculates OR with the parallel input.	p.5-23
RT	RT <0:OFF/ 1:ON> <0><delimiter>	OK <delimiter>	Executes the reset input. * Calculates OR with the parallel input.	p.5-23
LD	LD <0: ON/1: OFF> <delimiter>	OK <delimiter>	Turns ON/OFF the logical beam.	p.5-24

Command name	Format	Return value *1	Details	Refer
VR	VR <delimiter>	<type/version> <delimiter>	Acquires the system version information. EX. ZW-C10 1.100 <delimiter>	p.5-24
CA	CA <0> <delimiter>	OK <delimiter>	Calibrates the Sensor Head.	p.5-25
LS *2	LS <save intervals> <save count> <delimiter>	OK <delimiter>	Starts the internal logging of the data.	p.5-26
LE *2	LE <delimiter>	OK <delimiter>	Ends the internal logging of the data.	p.5-27
LO *2	LO <task number>	OK <delimiter>	Acquires the internal logging data.	p.5-27
LC *2	LC <<delimiter>	OK <delimiter>	Clears the internal logging data.	p.5-28
LI *2	LI <delimiter>	<Operation status> <Saved data count> <delimiter>	Acquires the internal logging information.	p.5-29
DV	DV <delimiter>	OK <delimiter>	Saves all bank data and system settings to EEPROM.	p.5-30

*1 If the command was not successfully processed, "ER <delimiter>" is returned.
*2 This can only be used via Ethernet.

Command format

■ Measurement command <MS command>

Acquire the current measured value.

* The same can be processed with the M, MEASURE command, which is in a ZS series format.

<Command format>

M	S		*	CR

↑ Space

↑ Task number

<Response format>

• Normal measurement (Task numbers 0 to 3)

(Example) -30.719923 mm

		-	3	0	7	1	9	9	2	3	CR

- The return value is right-aligned and 11 characters + delimiter.
- The unit of the measured values is nm.
- Spaces will fill any missing portion from the left.
- If the task number is omitted, the measured value displayed is acquired.

• Normal measurement (Task number 4)

(Example) TASK1 = -3.071992 mm, TASK2 = -2.998122 mm, TASK3 = 2.345678 mm,
TASK4 = 2.471249 mm

			-	3	0	7	1	9	9	2	,
			-	2	9	9	8	1	2	2	,
				2	3	4	5	6	7	8	,
				2	4	7	1	2	4	9	CR

• When measurement is not possible

-	-	-	-	-	-	-	-	-	-	-	CR

• When a command was not successfully processed

E	R	CR

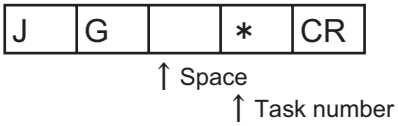
<Parameter explanation>

Parameter	Details
Task number	Specifies the number of the task of which the measurement result is to be output. 0: TASK1 1: TASK2 2: TASK3 3: TASK4 4: TASK1 to 4

■ Judgment result acquisition command <JG command>

Acquires the judgment result of the specified task.

<Command format>



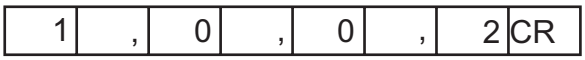
<Response format>

• Normal processing (Task numbers 0 to 3)

(Example) When the judgment result is "HIGH"

• Normal processing (Task number 4)

(Example) When the TASK1 judgment result is "HIGH," the TASK2/TASK3 judgment results are "PASS," and TASK4 judgment result is "LOW"



• When a command was not successfully processed

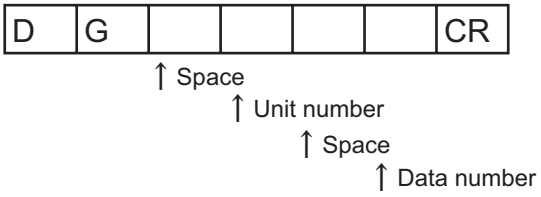
<Parameter explanation>

Parameter	Details
Task number	Specifies the number of the task of which the judgment result is to be output. 0: TASK1 1: TASK2 2: TASK3 3: TASK4 4: TASK1 to 4
Judgment result	Displays the Judgment result. PASS: 0 HIGH: 1 LOW: 2 ERROR: 3

■ Processing unit data acquisition command <DG command>

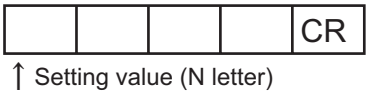
Acquire the measurement data and setting data of the processing unit.

<Command format>



<Response format>

• Normal processing



• When a command was not successfully processed

<Parameter explanation>

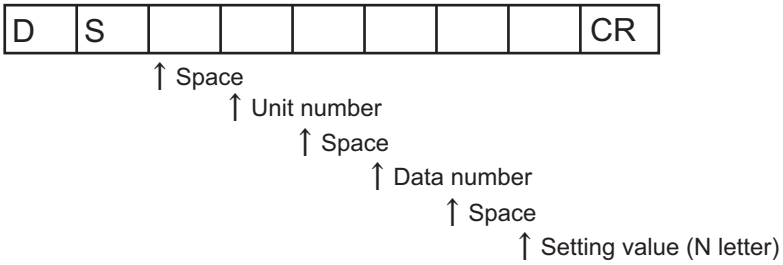
Parameter	Details
Unit number	Specifies the unit number (0 to 255) to be acquired.
Data number	Specifies the data number (0 to 255) to be acquired.

For unit numbers and data numbers, refer to "Processing Item Data List" (p.7-13)

■ Processing unit data setting command <DS command>

Change the setting data of the processing unit.

<Command format>



<Response format>

• Normal processing

• When a command was not successfully processed

<Parameter explanation>

Parameter	Details
Unit number	Specifies the unit number (0 to 255) to be acquired.
Data number	Specifies the data number (0 to 255) to be acquired.
Setting value	This is the setting value of the specified data.

For unit numbers and data numbers, refer to "Processing Item Data List" (p.7-13)

■ Current bank acquisition command <BG command>

Acquire the current bank number.

<Command format>

B	G	CR

<Response format>

• Normal processing

	CR

↑ Bank number

• When a command was not successfully processed

E	R	CR

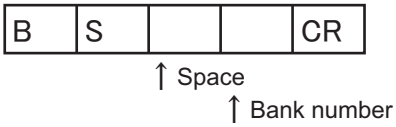
<Parameter explanation>

Parameter	Details
Bank number	Displays the current bank number. 0: BANK1 1: BANK2 2: BANK3 3: BANK4 4: BANK5 5: BANK6 6: BANK7 7: BANK8

■ Current bank setting command <BS command>

Replace the current bank number by the specified bank number.

<Command format>



<Response format>

• Normal processing

• When a command was not successfully processed

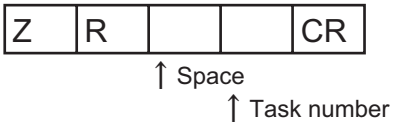
<Parameter explanation>

Parameter	Details
Bank number	Specifies the bank number to switch to. 0: BANK1 1: BANK2 2: BANK3 3: BANK4 4: BANK5 5: BANK6 6: BANK7 7: BANK8

■ Zero reset execution command <ZR Command>

Execute a zero reset for the specified task.

<Command format>



<Response format>

• Normal processing

- If the task number is omitted, the zero reset is executed for the task of which the result is currently displayed.
- If "4" is set for the task number, the zero reset is executed for all tasks.

• When a command was not successfully processed

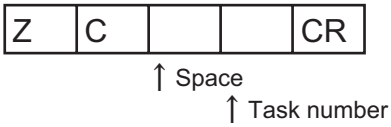
<Parameter explanation>

Parameter	Details
Task number	Specifies the number of the task for which the zero reset is to be executed. 0: TASK1 1: TASK2 2: TASK3 3: TASK4 4: TASK1 to 4

■ Zero reset execution command <ZC command>

Cancel the zero reset of the specified task.

<Command format>



<Response format>

• Normal processing

- If the task number is omitted, the zero reset is cancelled for the task of which the result is currently displayed.
- If "4" is set for the task number, the zero reset is cancelled for all tasks.

• When a command was not successfully processed

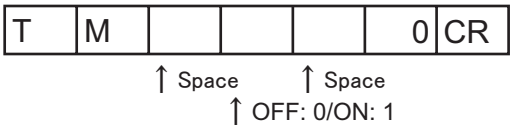
<Parameter explanation>

Parameter	Details
Task number	Specifies the number of the task for which the zero reset is to be cancelled. 0: TASK1 1: TASK2 2: TASK3 3: TASK4 4: TASK1 to 4

■ Timing input command <TM command>

Execute the timing input.

<Command format>



<Response format>

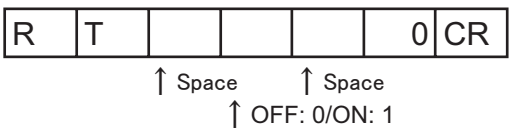
• Normal processing

• When a command was not successfully processed

■ Reset input command <RT command>

Execute the reset input.

<Command format>



<Response format>

• Normal processing

• When a command was not successfully processed

■ White LED OFF input command <LD command>

Turn ON/OFF the logical beam.

<Command format>

L	D				0	CR

↑ Space ↑ Space
↑ ON: 0/OFF: 1

<Response format>

• Normal processing

O	K	CR

• When a command was not successfully processed

E	R	CR

■ Version information acquisition command <VR command>

Acquire the system version information.

<Command format>

V	R		CR

↑ Space

<Response format>

• Normal processing

Z	W	-	C	1	0		1		0	0	0	CR

• When a command was not successfully processed

E	R	CR

■ Sensor head calibration command <CA command>

Calibrate the Sensor Head.

<Command format>

C	A		0	CR

↑ Space

<Response format>

• Normal processing

O	K	CR

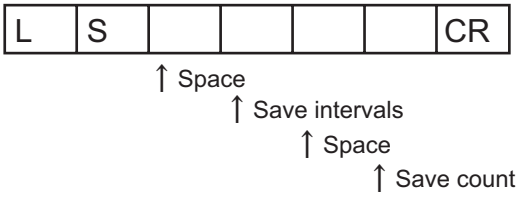
• When a command was not successfully processed

E	R	CR

■ Internal logging start command <LS command>

Start the internal logging of the data.

<Command format>



<Response format>

• Normal processing

• When a command was not successfully processed

<Parameter explanation>

Parameter	Details
Save intervals	Sets the save cycle (1 to 1,000) for the data to be internally logged.
Save count	Sets the maximum data count (1 to 12,800) to be internally logged. The internal logging process ends when the number of internal logging data reaches the maximum.

■ Internal logging end command <LE command>

End the internal logging of the data.

<Command format>

L	E	CR

<Response format>

• Normal processing

O	K	CR

• When a command was not successfully processed

E	R	CR

■ Internal logging data acquisition command <LO command>

Acquire the internal logging information.

<Command format>

L	O	CR

<Response format>

• Normal processing

O	K	CR

• When a command was not successfully processed

E	R	CR

■ Internal logging data clear command <LC command>

Clear the internal logging data.

<Command format>

L	C	CR

<Response format>

• Normal processing

O	K	CR

• When a command was not successfully processed

E	R	CR

■ Internal logging data information acquisition command <LI command>

Acquire the internal logging information.

<Command format>

L	I	CR

<Response format>

• Normal processing

			CR

↑ Operation status
↑ Space
↑ Saved data count

• When a command was not successfully processed

E	R	CR

<Parameter explanation>

Parameter	Details
Operation status	Displays the internal logging process status. 0: Internal logging stopped 1: Internal logging in process
Saved data count	Displays the number of saved logging data (0 and more).

■ Data save command <DV command>

Save all bank data and system settings to EEPROM.

<Command format>

D	V	CR

<Response format>

• Normal processing

O	K	CR

• When a command was not successfully processed

E	R	CR

Chapter 6
SPECIFICATIONS AND EXTERNAL DIMENSIONS

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Sensor Head

Specifications

Item		Specifications	
		ZW-S20	ZW-S40
Measuring center distance		20 mm	40 mm
Measuring range		±1 mm	±6 mm
Static resolution *1		0.25 μm	0.25 μm
Linearity *2		±1.2 μm	±7.0 μm
Spot diameter *3	Near	ϕ45 μm	ϕ90 μm
	Center	ϕ40 μm	ϕ80 μm
	Far	ϕ45 μm	ϕ90 μm
Measuring cycle		500 μs to 10 ms	
Operating ambient illumination		Illumination on object surface 10,000 lx or less: incandescent light	
Ambient temperature range		Operating: 0 to +50 °C, Storage: -15 to +60 °C (with no icing or condensation)	
Ambient humidity range		Operating and storage: 35 % to 85 % (with no condensation)	
Degree of protection		IP40 (IEC60529)	
Vibration resistance (destructive)		10 to 150 Hz, 0.35 mm single amplitude, 80 min each in X, Y, and Z directions	
Shock resistance (destructive)		150 m/s² 3 times each in six directions (up/down, left/right, forward/backward)	
Temperature characteristic *4		1.5 μm/°C	4.8 μm/°C
Materials		Case: aluminum die-cast Fiber cable sheat: PVC Calibration ROM: PC	
Fiber cable length		0.3 m, 2 m (Flex-resistant cable)	
Fiber cable minimum bending radius		20 mm	
Insulation resistance (Calibration ROM)		Between case and all terminals: 20 MΩ (by 250 V megger)	
Dielectric strength (Calibration ROM)		Between case and all terminals: 1,000 V AC, 50/60 Hz, 1 min	
Weight		Approx. 105 g (Chassis, fiber cable total)	
Accessories		Instruction sheet, Fixing screw (M2) for Calibration ROM, Precautions for correct use	

*1 Capacity value when Omron standard mirror surface target is measured at the measurement center distance as the average of 4,096 times

*2 Material setting for the Omron standard mirror surface target: Error from an ideal straight line when measuring on mirror surface
The reference values for linearity when targets to measure other than the above are as in the table below.

Item	ZW-S20	ZW-S40
Grass	±1.2 μm	±7.0 μm
SUS BA	±1.4 μm	±8.5 μm
White ceramic	±1.7 μm	±9.5 μm

*3 Capacity value defined by 1/e2 (13.5 %) of the center optical intensity in the measured area

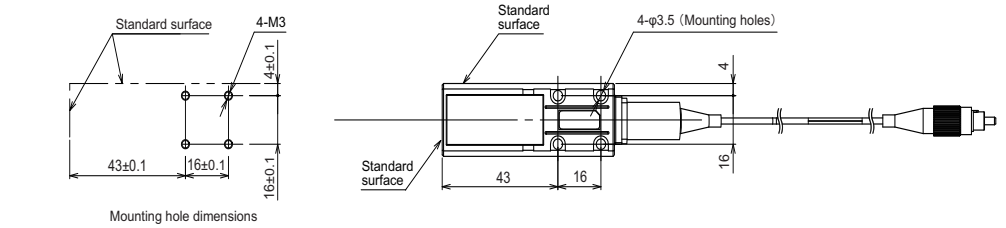
*4 Temperature characteristic at the measurement center distance when fastened with an aluminum jig between the Sensor Head and the target and the Sensor Head and the controller are set in the same temperature environment

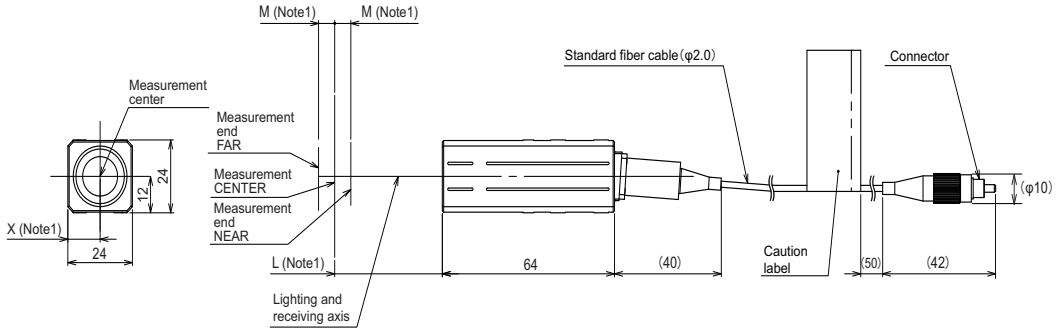
External Dimensions

■ ZW-S20/S40

Note 1

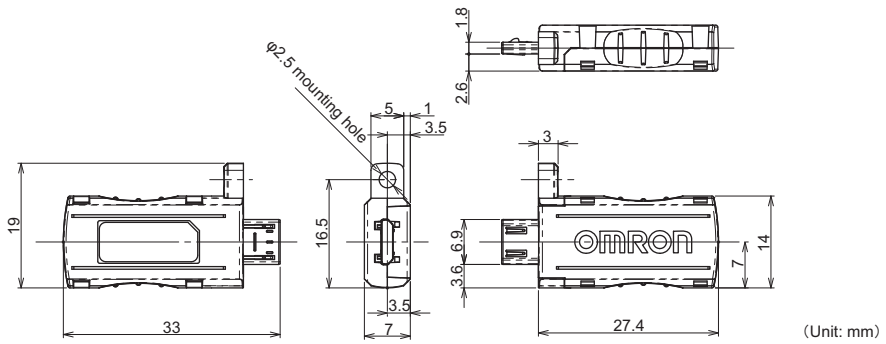
Type	L	M	X
ZW-S20	20	1	11.8
ZW-S40	40	6	11.7





(Unit: mm)

● Calibration ROM (ZW-XROM) *

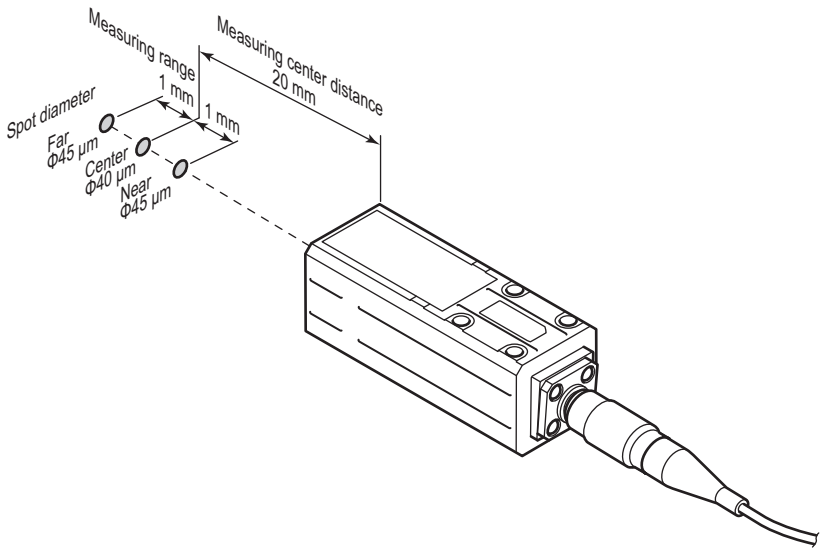


(Unit: mm)

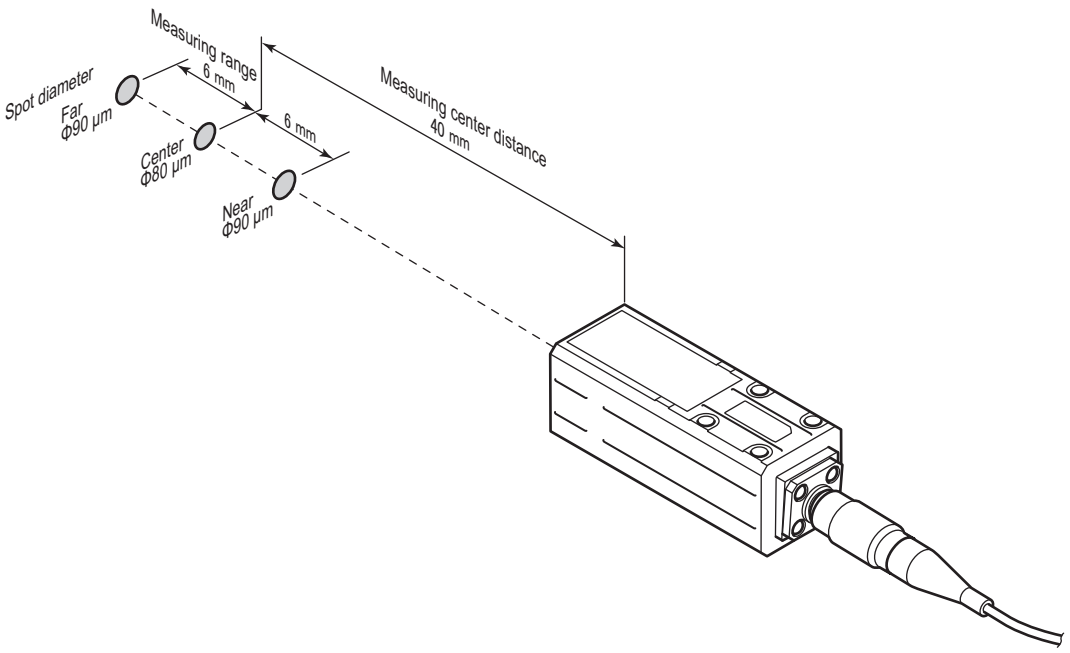
* This comes with the Sensor Head ZW-S20/S40. Be sure to use a Calibration ROM together with the Sensor Head with the same serial number.

Spot Diameter

■ ZW-S20



■ ZW-S40

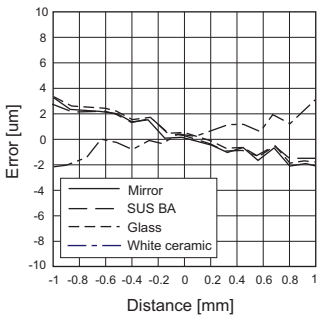


Linearity Characteristic by Materials

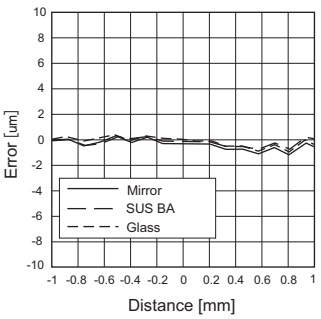
The measured distance displayed on the main display expresses the measurement center distance as 0 with the near side from the sensor as + and the far side as -.

■ ZW-S20

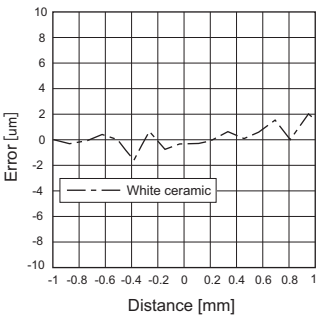
Material setting: Normal



Material setting: Mirror surface

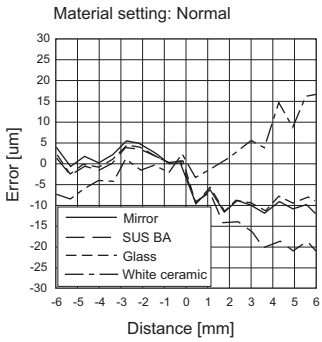


Material setting: Diffusion surface

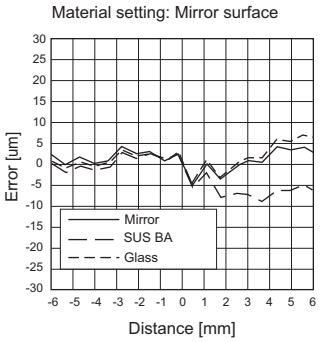


■ ZW-S40

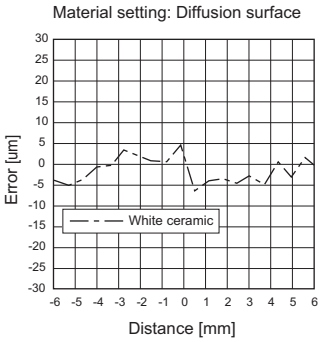
Material setting: Normal



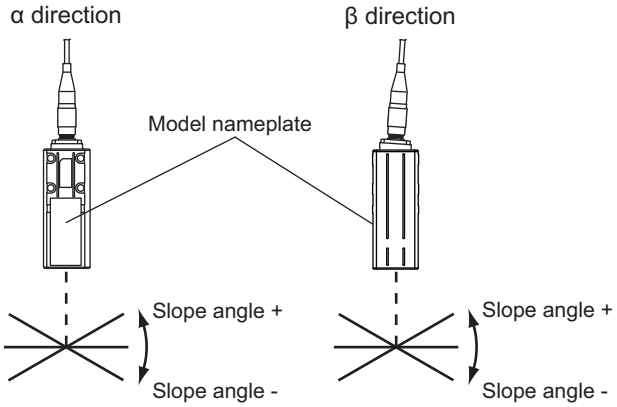
Material setting: Mirror surface



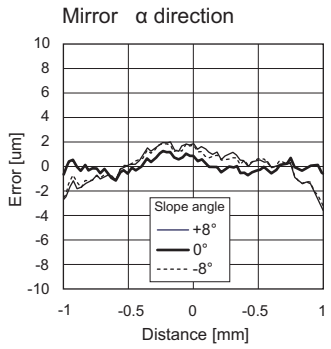
Material setting: Diffusion surface

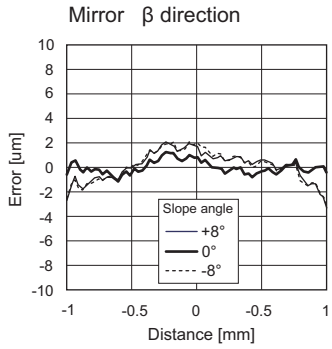


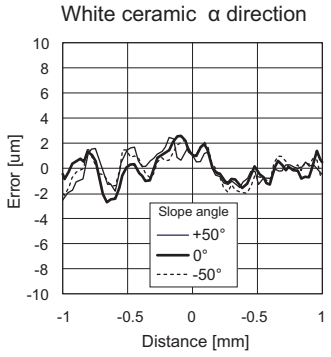
Angle Characteristic

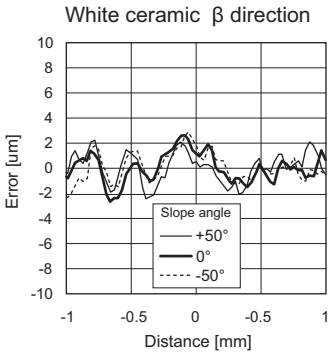


■ ZW-S20



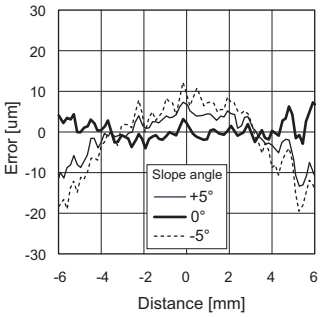




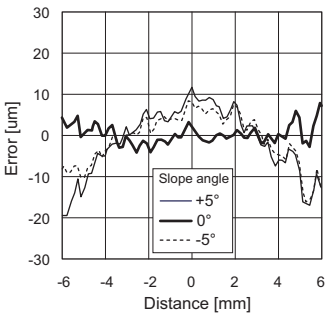


■ ZW-S40

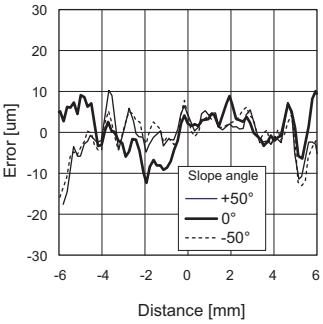
Mirror α direction



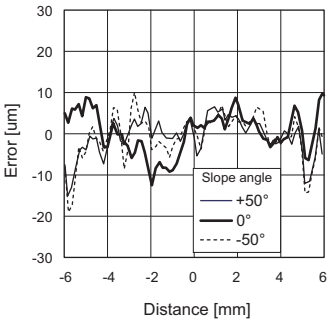
Mirror β direction



White ceramic α direction



White ceramic β direction



Controller

Specifications

Item				Specifications			
				ZW-C10T	ZW-C10AT	ZW-C15T	ZW-C15AT
Input/Output type				NPN		PNP	
Number of connected Sensor Heads				1 per Controller			
Sensor Head compatibility				Available			
Light source for measurement				White LED			
Segment display	Main display			11-segment red display, 6 digits			
	Sub-display			11-segment green display, 6 digits			
LED display	Status indicators			HIGH (orange), PASS (green), LOW (orange), STABILITY (green), ZERO (green), ENABLE (green), THRESHOLD-H (orange), THRESHOLD-L (orange), RUN (green)			
External interface	Ethernet			1 port , 100BASE-TX, 10BASE-T			
	RS-232C			1 port, 115,200 bps max.			
	20-pole terminal block	Judgment output (HIGH1/PASS1/LOW1)		Transistor output system Output voltage: 21.6 to 30 VDC Load current: 50 mA or less Residual voltage when turning ON: 1.2 V or less Leakage voltage when turning OFF: 0.1 mA or less			
		BUSY output (BUSY1)					
		ALARM output (ALARM1)					
		ENABLE output (ENABLE)					
		Analog voltage output (OUT1V)		-10 to +10 V, Output impedance: 100 Ω			
		Analog current output (OUT1A)		4 to 20 mA, Max. load resistance: 300 Ω			
		LED OFF input (LED OFF1)		DC input system Input voltage: 24 VDC ±10 % (21.6 to 26.4 VDC) Input current: 7 mA Typ. (24 VDC) Voltage/Current when turning ON: 19 V/3 mA or more Voltage/Current when turning OFF: 5 V/1 mA or less			
		ZERO RESET input (BUSY1)					
		TIMING output (TIMING1)					
		RESET output (RESET1)					
	52-pole extension connector	Binary	Measured value output (BAINARY 0 to 20)	Transistor output system Output voltage: 21.6 to 30 VDC Load current: 50 mA or less Residual voltage when turning ON: 1.2 V or less Leakage voltage when turning OFF: 0.1 mA or less			
			Gate signal output (GATE)				
			Selected task output (BINARY_OUT1/2)				
			Selected task input (BAINARY_SEL1/2)	DC input system Input voltage: 24 VDC ±10 % (21.6 to 26.4 VDC) Input current: 7 mA Typ. (24 VDC) Voltage/Current when turning ON: 19 V/3 mA or more Voltage/Current when turning OFF: 5 V/1 mA or less			

Item				Specifications			
				ZW-C10T	ZW-C10AT	ZW-C15T	ZW-C15AT
External interface	52-pole extension connector	Bank	Selected bank output (BANK_OUT 1 - 3)	Transistor output system Output voltage: 21.6 to 30 VDC Load current: 50 mA or less Residual voltage when turning ON: 1.2 V or less Leakage voltage when turning OFF: 0.1 mA or less			
			Selected bank input (BANK_SEL 1 -3)	DC input system Input voltage: 24 VDC ±10 % (21.6 to 26.4 VDC) Input current: 7 mA Typ. (24 VDC) Voltage/Current when turning ON: 19 V/3 mA or more Voltage/Current when turning OFF: 5 V/1 mA or less			
Main functions	Exposure time			Auto/Manual			
	Measuring cycle			500 μm to 10 ms			
	Material setting			Standard/Mirror/Diffusion surfaces			
	Measurement Item			Height/Thickness/Calculation			
	Filtering			Median/Average/Differentiation/High pass/Low pass/Band pass			
	Outputs			Scaling/Different holds/Zero reset/Logging for a measured value			
	Display			Measured value/Threshold value/Analog output voltage or current value/Judgment result/Resolution/Exposure time			
	Number of configurable banks			Max. 8 banks			
	Task process			Multi-task (up to 4 tasks per bank)			
	System			Save/Initialization/Display measurement information/ Communication settings/Sensor Head calibration/Key-lock/ Trigger-key input			
Ratings	Power supply voltage			21.6 V to 26.4 VDC (including ripple)			
	Current consumption			500 mA max.			
	Insulation resistance			Across all lead wires and controller case: 20 MΩ (by 250 V megger)			
	Dialectic strength			Across all lead wires and controller case: 1,000 VAC, 50/60 Hz, 1 min			
Environmental immunity	Degree of protection			IP20 (IEC60529)			
	Vibration resistance (destructive)			10 to 55 Hz, 0.35-mm single amplitude, 50 min each in X, Y, and Z directions			
	Shock resistance (destructive)			150 m/s^2, 3 times each in six directions (up/down, left/right, forward/backward)			
	Ambient temperature			Operating: 0 to +40 °C Storage: -15 to +60 °C (with no icing or condensation)			
	Ambient humidity			Operating and storage: 35 % to 85 % (with no condensation)			
Grounding				D-type grounding (Grounding resistance of 100 Ω or less) Note: For conventional Class D grounding			
Materials				Case: PC			
Weight				Approx. 750 g (main unit only)			
Accessories				Instruction sheet, Member registration sheet	Instruction sheet, Member registration sheet and software for setting (CD-ROM)	Instruction sheet, Member registration sheet	Instruction sheet, Member registration sheet and software for setting (CD-ROM)

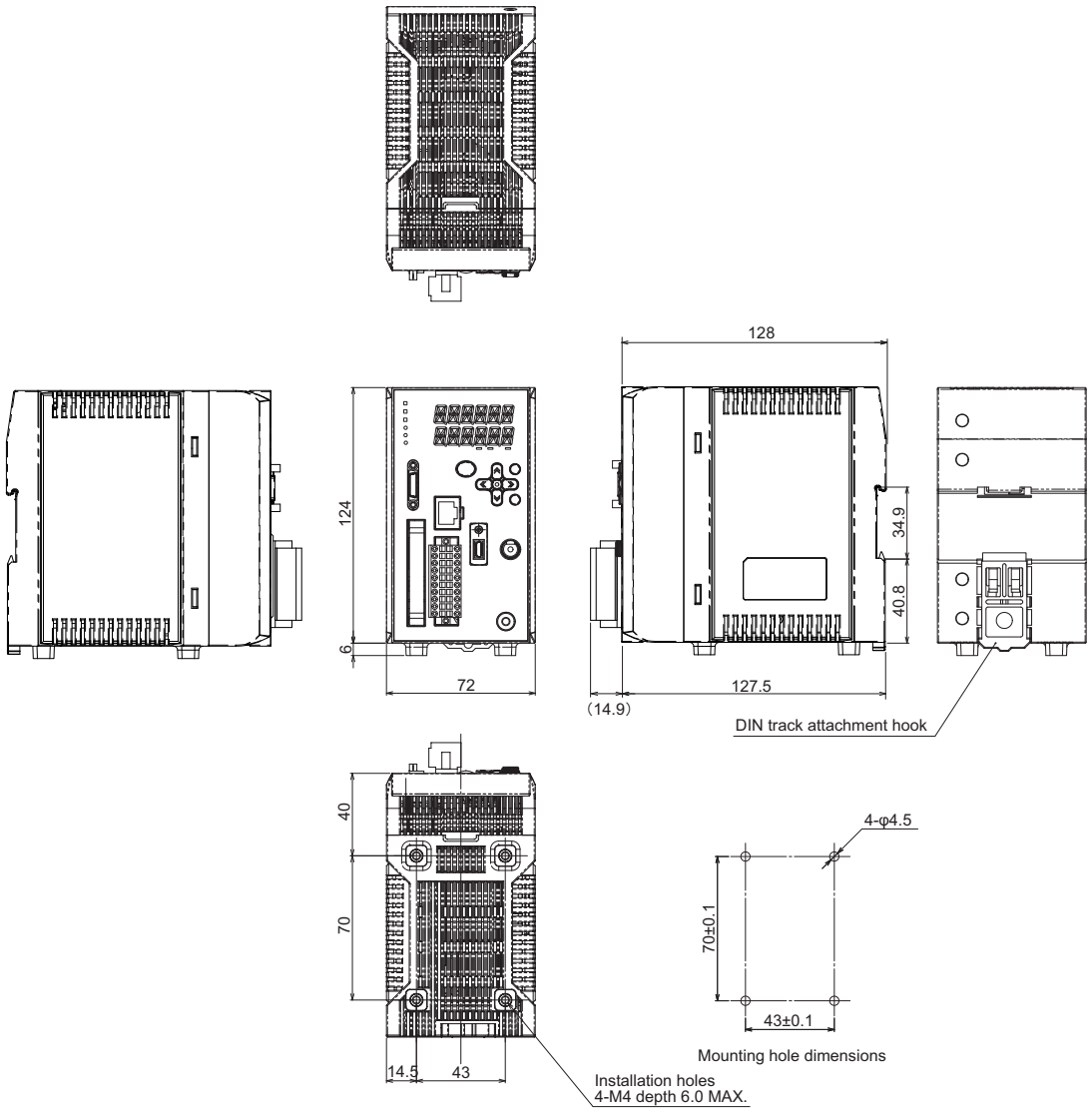
Status Indicators for Controller

Measurement mode	Status		Display	Output			Input		RS-232C/ Ethernet
			11 segment display	Analog output	Judgment output (HIGH/ PASS/ LOW)	Binary output	LED OFF	Zero reset	
RUN	Normal measurement		Measurement result	Output according to the measurement result	Judgment result	Output according to the mode (Measurement result/ Judgment result)	Enabled	Enabled	Enabled
	Measurement error	Keep	Previous value						
		Clamp	"------"	Output at clamp level	Output OFF	Output of the measured value: clamp level Judgment output: Output OFF		Disabled	
	Measured value not determined		-						
	LED OFF		-						
FUN	-		Display according to the menu						Disabled
System error	-		"SYS.ERR" blinking	Voltage: Output of 0 V Current: Output of 12 mA			Disabled		Enabled A command is received but is not executed.
When starting	-		"INIT"	Output at clamp level (approx. -10.8 V)		Output OFF			Disabled (Note)

Note: Do not obtain data during start-up. The RS-232C output is indeterminate at this time.

External Dimensions

■ ZW-C10T/C15T/C10AT/C15AT

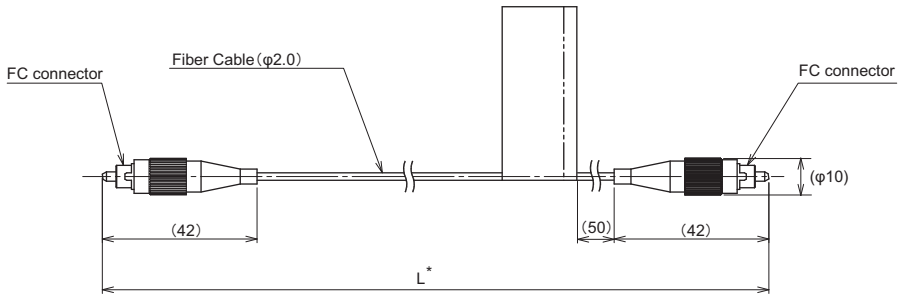


(Unit: mm)

Accessories

Extension Fiber Cable

■ ZW-XF02R/XF05R/XF10R/XF20R/XF30R



(Unit: mm)

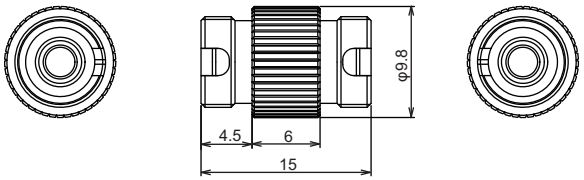
* The following table lists cable lengths per models.

Type	Specification	L (mm)
ZW-XF02R	2 m	2000±20
ZW-XF05R	5 m	5000±50
ZW-XF10R	10 m	10000±100
ZW-XF20R	20 m	20000±200
ZW-XF30R	30 m	30000±300

Item	Specifications				
	ZW-XF02R	ZW-XF05R	ZW-XF10R	ZW-XF20R	ZW-XF30R
Ambient temperature	Operating: 0 to +50 °C Storage: -15 to +60 °C (with no icing or condensation)				
Ambient humidity	Operating and storage: 35 % to 85 % (with no condensation)				
Vibration resistance (destructive)	10 to 55 Hz, 0.35-mm single amplitude, 50 min each in X, Y, and Z directions				
Shock resistance (destructive)	150 m/s^2, 3 times each in six directions (up/down, left/right, forward/backward)				
Fiber length	2 m	5 m	10 m	20 m	30 m
Materials	Case: PC, Connector part: Brass				
Minimum bending radius	20 mm				
Weight	Approx. 30 g	Approx. 40 g	Approx. 60 g	Approx. 110 g	Approx. 150 g
Accessories	Connecting Adapter (ZW-XFC), Instruction sheet				

Connecting Adapter (For Fiber Cable Connection)

■ ZW-XFC

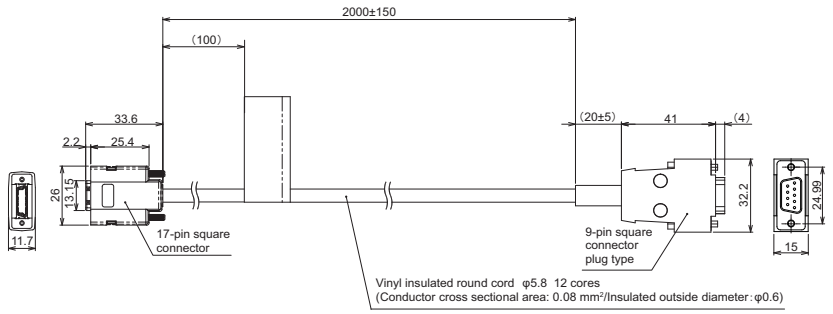


(Unit: mm)

The connection adapter (ZW-XFC) comes packed together with the extension fiber cable (ZW-XF_R), but the connection adapter alone can be purchased for maintenance.

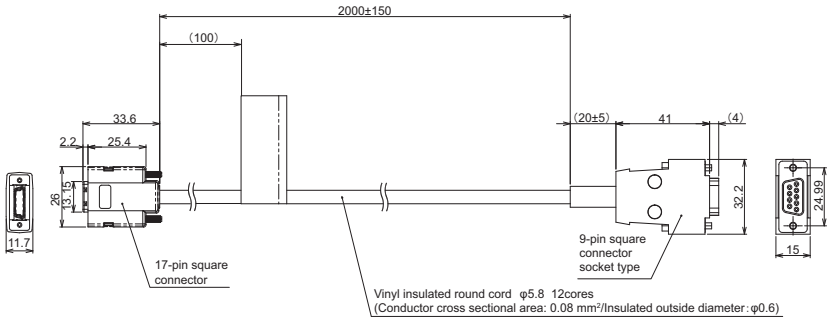
RS-232C Cable

■ ZW-XPT2 (For connecting to PLC or programmable terminal)



(Unit: mm)

■ ZW-XRS2 (For connecting to personal computer)

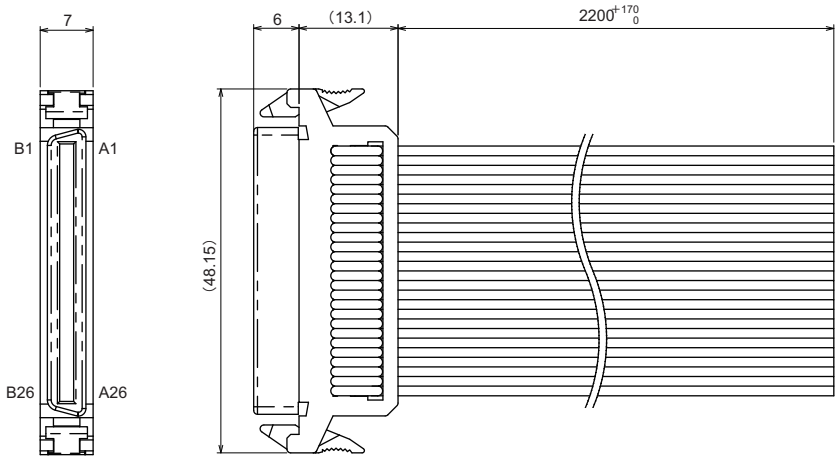


(Unit: mm)

Item	Specifications	
	ZW-XPT2	ZW-XRS2
Applicable controller	ZW series	
Ambient temperature	Operating: 0 to +50 °C Storage: -15 to +60 °C (with no icing or condensation)	
Ambient humidity	Operating and storage: 35 % to 85 % (with no condensation)	
Dialectic strength	Across all lead wires and controller case: 1,000 VAC, 50/60 Hz, 1 min	
Insulation resistance	Across all lead wires and controller case: 20 MΩ (by 250 V megger)	
Vibration resistance (destructive)	10 to 55 Hz, 0.35-mm single amplitude, 50 min each in X, Y, and Z directions	
Shock resistance (destructive)	150 m/s², 3 times each in six directions (up/down, left/right, forward/backward)	
Materials	Cable sheath: PVC	
Minimum bending radius	35 mm	
Weight	Approx. 150 g	
Accessories	Instruction sheet	

Parallel Cable

■ ZW-XCP2



(Unit: mm)

Item	Specifications
Applicable controller	ZW series
Ambient temperature	Operating: 0 to +50 °C Storage: -15 to +60 °C (with no icing or condensation)
Ambient humidity	Operating and storage: 35 % to 85 % (with no condensation)
Dielectric strength	Across all lead wires and controller case: 1000 VAC, 50/60 Hz, 1 min
Insulation resistance	Across all lead wires and controller case: 20 MΩ (by 250 V megger)
Vibration resistance (destructive)	10 to 55 Hz, 0.35-mm single amplitude, 50 min each in X, Y, and Z directions
Shock resistance (destructive)	150 m/s², 3 times each in six directions (up/down, left/right, forward/backward)
Materials	Cable sheath: PVC
Minimum bending radius	5.5 mm
Weight	Approx. 240 g
Accessories	Instruction sheet

Chapter 7
APPENDIX

Troubleshooting	7-2
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Processing Item Data List	7-13
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Troubleshooting

This section describes countermeasures for temporary hardware problems.
Check the items below before sending the hardware for repair.

Error type	Problem	Probable cause	Possible countermeasure	Page
Starting error	Device restarts during operation.	The power supply device is not connected correctly.	Check if the power supply device conforms to the power supply specifications.	p.6
		The power supply capacity is insufficient.		
Display error	The main display remains on "- - - - - -."	The target to measure is not in the measuring range.	Place the target to measure in the measuring range.	p.1-8 p.6-4
		TIMING is not input.	Enter a TIMING signal.	p.4-2 p.4-8
		The trigger level is not appropriately set for self-trigger.	Set the self-trigger level to an appropriate value.	p.3-32
		Refer to the "The measured values fluctuate." and "The logical beam does not come out of the Sensor Head." items below.		-
	The main display becomes "SYSERR."	A system error has occurred.	Identify the cause of the error based on the error code displayed on the sub-display and take an appropriate action.	p.7-5
Measurement error	Abnormal distances are displayed in areas clearly outside the measuring range.	Such phenomena are characteristic of the sensor.	• Check the target to measure and the measuring distance. • Lowering the expose time setting value may improve the situation.	p.3-3
	The measured values fluctuate.	The average count is not set correctly.	Set the average count correctly.	p.3-16
		The target to measure and the Sensor Head are vibrating.	Implement a vibration-control countermeasure.	-
		The fiber cable edge or the lens surface of the Sensor Head is dirty.	Clean the surface.	p.9 p.1-16
		The connection between the Sensor Head and the controller or the connection with the extension fiber cable is not normal.	Check the fiber cable connections.	p.1-16
		The fiber cable is disconnected.	Replace the fiber cable.	-
		The Sensor Head lens is broken.	The Sensor Head needs to be repaired. Please contact an OMRON branch or sales office. For sensor head repair, return as a set with the Calibration ROM.	-
		Water and/or oil droplets are attached.	Perform air purging and so forth to remove the droplets.	-

Error type	Problem	Probable cause	Possible countermeasure	Page
Measurement error Input error	The measured values fluctuate.	Intense ambient light is present.	• Shield the ambient light. • Increase the background removal level.	Smart Monitor ZW Operation Manual
		Mutual interference is occurring.	Check the Sensor Head installation position.	p.1-9
	The measured values fluctuate gradually.	The operating ambient temperature is fluctuating.	• Maintain a certain operating ambient temperature. • Execute zero reset periodically using the standard object.	p.2-15
		The warm-up time is inadequate.	Wait 30 minutes after switching ON the power before using.	-
	The measured values differ from the intended values.	The target to measure is inclined or the position is offset.	Place the target to measure correctly in the measuring range.	p.1-8
		The scaling has not been done correctly.	Check the scaling setting.	p.3-21
		The zero reset value is not correct.	Set the zero reset correctly.	p.3-37
		The Sensor Head has not been calibrated correctly.	Recalibrate the Sensor Head.	p.1-19
	Measured values are output even though there is no target.	The fiber cable edge or the lens surface of the Sensor Head is dirty.	Clean the surface.	p.1-16
		The connection between the Sensor Head and the controller or the connection with the extension fiber cable is not normal.	Check the fiber cable connections.	p.1-15
		Intense ambient light is present.	• Shield the ambient light. • Increase the background removal level.	Smart Monitor ZW Operation Manual
		Mutual interference is occurring.	Check the Sensor Head installation position.	p.1-9
	Measurement values are output even though the sensor head's fiber cable is not connected to the controller.	The controller side fiber connector is dirty.	Clean the surface.	p.1-16
	The logical beam does not come out of the Sensor Head.	The connection between the Sensor Head and the controller or the connection with the extension fiber cable is not normal.	Check the fiber cable connections.	p.1-15
		The fiber cable edge or the lens surface of the Sensor Head is dirty.	Clean the surface.	p.1-16
		The fiber cable is disconnected.	Replace the fiber cable.	p.1-15
		The LED_OFF input line is short-circuited.	Check the wiring.	p.4-2
Input error	No input signal received.	Cables are not connected correctly.	Check the input circuit and the wiring for proper connection.	p.4-2
		The signal line is disconnected.		

Error type	Problem	Probable cause	Possible countermeasure	Page
Output error	No judgment output to external.	Cables are not connected correctly.	Check the output circuit and the wiring for proper connection.	p.4-2
		The signal line is disconnected.		
		The signal logic is not correct.	Check the logic of the signal.	-
		The RESET input line is short-circuited.	Check the input circuit and the wiring for proper connection.	p.4-2
		The non-measurement setting is set to "Clamp" and measurement cannot be performed.	Set the non-measurement setting correctly. By selecting the non-measurement setting to "Keep", the judgment result before measurement is disabled can be output.	p.4-28
	The analog output is not correct.	Cables are not connected correctly.	Check the output circuit and the wiring for proper connection.	p.4-2
		The signal line is disconnected.		
		The voltage and current values are off the meter.	Set the correct focus based on the measured value.	p.4-14
		An oscilloscope or a high-speed A/D board is being used.	Use of these devices may reduce the resolution. Change the focus to minimize the impact.	p.4-14
	The binary output is not correct.	Cables are not connected correctly.	Check the output circuit and the wiring for proper connection.	p.4-3
		The signal line is disconnected.		
		The signal logic is not correct.	Check the logic of the signal.	-
		The load timing is not correct.	Check the timing charts.	p.4-33
		The binary output object task selection input is not correct.	Enter the binary output object task selection correctly.	p.4-10
Communication error	RS-232C communication cannot be established.	Cable wirings are wrong. Cables are not connected correctly.	Check the wiring to ensure proper connection.	p.5-7
		Communication settings are wrong.	Set the same communication setting for both the controller and the external devices.	p.5-10
	Ethernet communication cannot be established.	The Ethernet cable is not connected correctly.	Use a cross cable when connecting the controller directly with the personal computer.	p.5-5
		The IP address and subnet mask are not set correctly.	Set the IP address and subnet mask correctly. * The settings becomes effective after a reboot.	p.5-5
		The controller and an external device are not connected at a 1:1 ratio.	Connect the controller and an external device at a 1:1 ratio.	-
	Ethernet communication cannot be established.	The security setting is not appropriate.	Check if the communication is blocked due to the firewall setting on the external device.	-
Other	Key input is not allowed.	The key lock setting is turned ON.	Turn Off the key lock setting.	p.3-49

Error Messages and Countermeasures

■ Starting process errors

Error code	Abnormality	Cause	Countermeasure
2	The linearity correction data is invalid.	The linearity correction value loaded from the Calibration ROM is corrupt.	Check to make sure that the Calibration ROM is correctly inserted. If the error occurs when it is correctly inserted, the Calibration ROM or the controller may be broken. Please contact an OMRON branch or sales office. (Note)
3	The linearity correction data cannot be loaded.	The Calibration ROM is not inserted into the controller.	
7	The system setting is invalid.	The system settings saved to the controller are corrupt.	After holding down the Mode switching key, press the ZERO/SET key to clear the system settings and the bank data, then resume the starting process.
8	The bank data is invalid.	The bank data saved to the controller is corrupt.	

(Note)

If error code 3 is displayed, as a temporary measure, you can restart measurement using the Calibration ROM data read in the previous time.

<Operation method>

With error code 3 displayed on the sub-display, hold down the Mode switching key, then when "OK/CAN" is displayed, press the ZERO/SET key.

<Caution>

- When using this method, always check the Calibration ROM serial number read in previously in the "controller information" (p.3-47) and check that it matches the Sensor Head side serial number. Measurement will not be correct unless they match.
- When restarting the main unit, perform the same operations again.
- This operation is disabled for a controller into which no Calibration ROM has ever been inserted and started up.

■ Firmware update errors

Error code	Abnormality	Cause	Countermeasure
11	Unrecoverable error	The Warp Engine ZW is interrupted during an update.	Do not operate the Warp Engine ZW during an update. If this error occurs, turn on the controller power again and start over the update.

■ Ethernet communication errors

Error code	Abnormality	Cause	Countermeasure
23	IP address duplication error	The same IP address as that of the controller exists on the network.	A controller with the same IP address exists on the same network. Change the IP address setting. (see p.5-5)
25	Ethernet communication parameter error	An invalid IP address is set.	An invalid IP address is set for the controller. Set an appropriate IP address. (see p.5-5)

■ Measurement errors

Error code	Abnormality	Cause	Countermeasure
90	Abnormal measurement waveform	The receiving status (line brightness) during measurement is not appropriate.	Check if the Sensor cable is disconnected or broken. Furthermore, remove the cable from the controller, and clean the edge surface and reconnect. And then calibrate the Sensor Head. (see p.1-19)

If an error code other than the one listed above is displayed, the controller may be broken. Please contact an OMRON branch or sales office.

EMC Directive Conformity

CE Marking	Applicable directive		Safety category
	Low voltage directive	EMC directive	
Conformed *1	Not applicable	Conformed *1	B

*1 For more details on conformity level, please contact your OMRON sales representative to obtain "Declaration of Conformity: In compliance with EN45014).

Updating Firmware

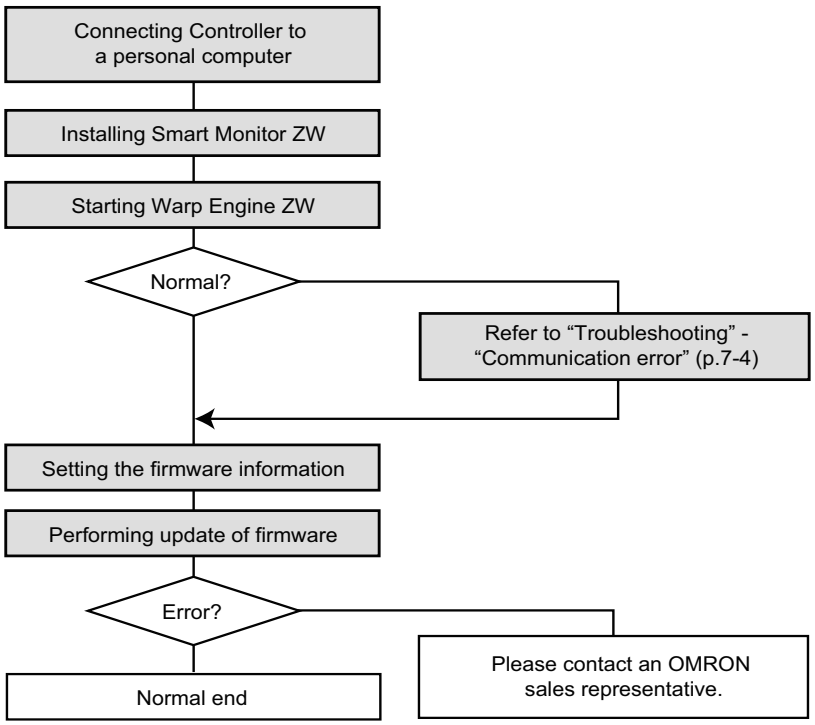
This section describes how to update the firmware of ZW Series Controllers.
Use Warp Engine ZW to update the firmware.
Warp Engine ZW is automatically installed when Smart Monitor ZW is installed.
The most recent version of the software can be downloaded from the following website for OMRON members. Refer to the Member Registration Sheet that is enclosed with the Controller.

http://www.omron-cxone.com/zw

CHECK!

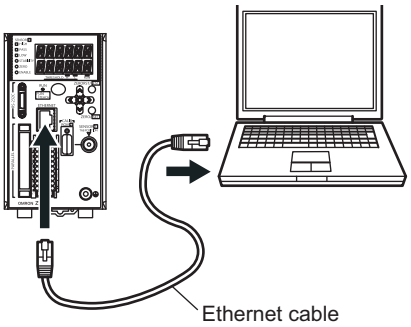
- While updating, do not turn off the power of the controller. The controller will not start normally.
- To install, log on as an Administrator or a user with system access rights.

Flow of Updating Firmware



Connecting the controller to a personal computer

1. Connect the controller to the personal computer by the Ethernet cable.



2. Turn on the power of the controller.

CHECK!

Make sure that the power of the controller is connected securely. When the power is turned off while updating, the controller breaks down and does not run normally.

Installing Smart Monitor ZW

3. Install Smart Monitor ZW to a personal computer.

Warp Engine ZW that is used for updating the firmware will be simultaneously installed.

Installation/Uninstallation Method p.1-23

Starting Warp Engine ZW

CHECK!

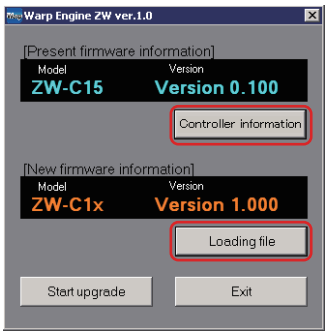
- Start Warp Engine ZW only when the personal computer recognizes the controller normally.
- Do not change the IP address and the subnet mask when using Warp Engine ZW on the same personal computer with which Smart Monitor ZW is used. If using a different personal computer, refer to p.5-5 to change the IP address and the subnet mask of the controller

4. **Select [Programs]-[OMRON]-[ZW]-[WarpEngineZW] from the Windows [Start] menu.**
The [Warp Engine ZW] screen is displayed.

When the startup of Warp Engine ZW fails, the following screen is displayed after a message appears. Set the connection port.

Setting the firmware information

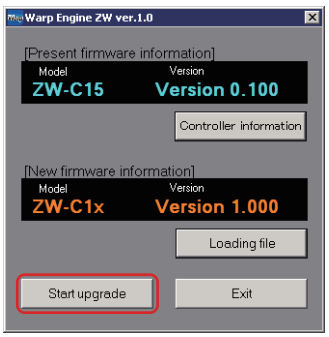
5. **Click the [Controller information] button as required.**
The model and version of the controller that is being connected currently are displayed.



6. **Click the [Loading file] button and select the file in which you want to write.**
The model and version of the controller that is held in the file are displayed.

Performing update of firmware

7. **Click the [Start upgrade] button.**

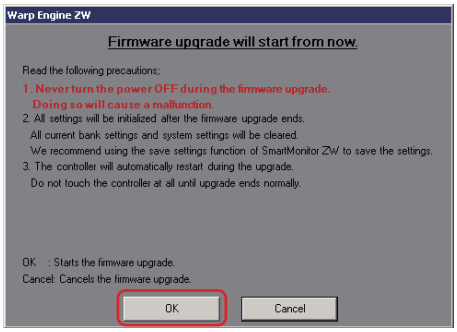


A message indicating the start of update appears.

CHECK!

If the message “the model is not the same” appears when you click the [Start upgrade] button, it means that the model of the connected controller and the model information in the specified file do not match. In this case, do not perform update. The controller will break down and will not start normally thereafter.

8. Check the contents of the message and click the [OK] button.



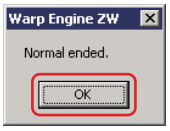
Update of the firmware will start.

The progress status is displayed during the processing of update. Wait until the message box indicating that the update has finished normally appears (it takes a few minutes to complete the update).

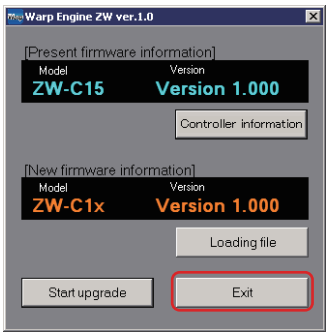
CHECK!

- An error may occur on the controller during update; however, please wait.
- If the progress bar stops while update is being performed, or update does not finish normally even after 10 minutes, there is a possibility that update may have failed.
  In this case, contact an OMRON sales representative about the firmware version before update and the one in the write file.

9. After update completes, the message appears. Click the [OK] button.



10. **Click the [Exit] button to exit the Warp Endine ZW.**



Processing Item Data List

Unit number	Processing Item	Data number	Palameter	Default value	Setting range/output range	Acquisition enabled / disabled	Setting enabled / disabled
0	Picture input	0	Mesured cycle	500	500 - 10000 (μs)	Yes	No
		22	2 area mode	0	0: OFF 1: ON	Yes	Yes
		23	Area tracking mode	0	0: No tracking 1: Track starting point 2: Track ending point 3: Track starting/ending points	Yes	Yes
		39	Surface subject to area tracking (Reference surface)	4	0: Edge 1st 1: Edge 2nd 2: Edge 3rd 3: Edge 4th 4: Light Peak	Yes	Yes
		40	Surface subject to area tracking (Tracking surface)	1	0: Edge 1st 1: Edge 2nd 2: Edge 3rd 3: Edge 4th 4: Light Peak	Yes	Yes
		193	2 area teaching	-	1: Excecute	No	Yes
1 (Note1)	Exposure Time Control (2 area mode OFF)	0	Exposure Time Control Mode	0	0: Auto 1: Manual	Yes	Yes
		2	Surface subject to exposure time control	4	0: Edge 1st 1: Edge 2nd 2: Edge 3rd 3: Edge 4th 4: Light Peak	Yes	Yes
		6	Exposure time fixed value	1000	1 to 5000 (μs)	Yes	Yes
		14	Exposure time upper limit	1000	1 to 5000 (μs)	Yes	Yes
		36	Exposure time	1000	1 to 5000 (μs)	Yes	No
		37	Received light amount (1st)	-	0 to 4095 (Gradation)	Yes	No
		38	Received light amount (2nd)	-	0 to 4095 (Gradation)	Yes	No
		39	Received light amount (3rd)	-	0 to 4095 (Gradation)	Yes	No
		40	Received light amount (4th)	-	0 to 4095 (Gradation)	Yes	No
20	Target to measure	1	Material	0	0: Normal 1: Mirror 2: Diffision	Yes	Yes
		4	Background removal level	100	0 to 4095 (Gradation)	Yes	Yes

(Note1) When using exposure time control with 2 area mode ON,
- Area 1 exposure time control: Unit number "1"
- Area 2 exposure time control: Unit number "2"

Unit number	Processing Item	Data number	Palameter	Default value	Setting range/output range	Acquisition enabled / disabled	Setting enabled / disabled
40	Measuring point	0	Measured item	1: TASK1 0: TASK2 to 3	0: None 1: Height 2: Thick 3: Calculation	Yes	Yes
		1	Measurement Surface 1	4	0: Edge 1st 1: Edge 2nd 2: Edge 3rd 3: Edge 4th 4: Light Peak	Yes	Yes
		2	Measurement Surface 2	4	0: Edge 1st 1: Edge 2nd 2: Edge 3rd 3: Edge 4th 4: Light Peak	Yes	Yes
		3	Parameter X	0	0: None 1: TASK1 2: TASK2 3: TASK3 4: TASK4	Yes	Yes
		4	Parameter Y	0	0: None 1: TASK1 2: TASK2 3: TASK3 4: TASK4	Yes	Yes
		5	Parameter K	0	-999999999 to 999999999	Yes	Yes
		6	Parameter m	0	-100 to 100 (1div: 0.1)	Yes	Yes
		7	Parameter n	0	-100 to 100 (1div: 0.1)	Yes	Yes
		13	Measuring area	0	0: Area1 1: Area2	Yes	Yes
41	Scaling	2	Scaling mode	0	0: Off 1: Height auto 2: manual 3: Thick auto	Yes	Yes
		3	Span value	10000	-20000 to 20000 (1div: 0.1)	Yes	Yes
		4	Offset value	0	-999999999 to 999999999 (nm)	Yes	Yes
42	Median	2	Median filter mode	0	0: Off 1: Count 3 2: Count 9 3: Count 15	Yes	Yes

Unit number	Processing Item	Data number	Palameter	Default value	Setting range/output range	Acquisition enabled / disabled	Setting enabled / disabled
43	Average	2	Average count	8: Count 256	0: Count 1 1: Count 2 2: Count 4 3: Count 8 4: Count 16 5: Count 32 6: Count 64 7: Count 128 8: Count 256 9: Count 512 10: Count 1024 11: Count 2048 12: Count 4096	Yes	Yes
44	Frequency filter	2	Filter type	0	0: Off 1: Highpass filter 2: Lowpass filter 3: Bandpass filter	Yes	Yes
		3	Cutoff frequency	1	1 to 999999 (1div: 0.001)	Yes	Yes
		4	Cutoff frequency (upper limit)	999999	1 to 999999 (1div: 0.001)	Yes	Yes
		5	Cutoff frequency (lower limit)	1	1 to 999999 (1div: 0.001)	Yes	Yes
45	Differentiation	2	Differentiation mode	0	0: Off 1: On	Yes	Yes
		3	Differentiation cycle	1	1 to 5000 (ms)	Yes	Yes
46	Hold	2	Hold mode	0	0: Off 1: Peak 2: Bottom 3: Peak to peak 4: Auto peak 5: Auto bottom 6: Auto peak to peak 7: Average 8: Sample	Yes	Yes
		3	Trigger method	0	0: Timing 1: Self-up trigger 2: Self-down trigger	Yes	Yes
		4	Trigger level	0	-999999999 to 999999999 (nm)	Yes	Yes
		5	Trigger hys	0.05% of measuring range	0 to 999.999999 (mm)	Yes	Yes
		6	Trigger delay time	1	1 to 5000 (ms)	Yes	Yes
		7	Sampling time	100	1 to 5000 (ms)	Yes	Yes
		8	Trigger delay mode	0	0: Off 1: On	Yes	Yes

Unit number	Processing Item	Data number	Palameter	Default value	Setting range/output range	Acquisition enabled / disabled	Setting enabled / disabled
47	Zero reset	5	Offset when a zero reset is executed	0	-999999999 - 999999999 (nm)	Yes	Yes
		7	Zero reset mode	0	0: Real 1: Hold	Yes	Yes
		64	Zero reset execution enabled/disabled/Status	1	0: Off 1: On	Yes	Yes
49	Judgment output	2	LOW threshold value	-25% of measuring range	-999999999 to 999999999 (nm)	Yes	Yes
		3	HIGH threshold value	+25% of measuring range	-999999999 to 999999999 (nm)	Yes	Yes
120	Judgment processing	0	Hys width	0.05 % of measuring range	0 to 999999999 (nm)	Yes	Yes
		1	Timer mode	0	0: Off 1: Off delay 2: On delay 3: 1shot	Yes	Yes
		2	Delay time	1	1 to 5000 (ms)	Yes	Yes
		3	Task subject to judgment output	0	0: TASK1 1: TASK2 2: TASK3 3: TASK4	Yes	Yes
121	Processing when measurement cannot be performed	0	Mode when measurement cannot be performed	1	0: Keep 1: Clamp	Yes	Yes

Unit numbers 40 through 49 are parameters for the TASK1 processing unit. To reference the parameters for the processing unit for Task N, add 20 x (N - 1) to the unit number you want to reference.
(Example)
To change the average processing for TASK2,
Reference the parameters for
Processing unit number = 43 + 20 x (2 - 1) = 63
Data number = 2.

Unit number	Processing Item	Data number	Palameter	Default value	Setting range/output range	Acquisition enabled / disabled	Setting enabled / disabled
122	Analog output	2	Monitor focus mode	0	0: Off 1: On	Yes	Yes
		3	Monitor focus output position 1	-(measuring range)/2	-999.999999 to 999.999999 (mm)	Yes	Yes
		4	Monitor focus output position 2	+(measuring range)/2	-999.999999 to 999.999999 (mm)	Yes	Yes
		5	Monitor focus current low limit	4	4 to 20 (mA)	Yes	Yes
		6	Monitor focus current high limit	20	4 to 20 (mA)	Yes	Yes
		7	Monitor focus voltage low limit	-10	-10 to 10 (V)	Yes	Yes
		8	Monitor focus voltage high limit	10	-10 to 10 (V)	Yes	Yes
		21	Output target task	1	0: None 1: TASK1 2: TASK2 3: TASK3 4: TASK4	Yes	Yes
		23	Output level during clamping	0	Current output: 0: MAX (Approx. 21 mA) 1: 20 mA 2: 19 mA ... 16: 5 mA 17: 4 mA 18: MIN (Approx. 3 mA) Voltage output: 0: MAX (Approx. 10.8 V) 1: 10 V 2: 9 V ... 20: -9 V 21: -10 V 22: MIN (Approx. -10.8 V)	Yes	Yes

Unit number	Processing Item	Data number	Palameter	Default value	Setting range/output range	Acquisition enabled / disabled	Setting enabled / disabled
123	Binary output	8	Output during clamping	0	0: MAX 1: MIN	Yes	Yes
		11	Binary output target	1	0: None 1: Measurement value 1 2: Measurement value 2 3: Judgment value	Yes	Yes
		12	Binary output cycle	1	1 to 100 (cycle)	Yes	Yes
		21	TASK1 specified for data output	0	0: Off 1: On	Yes	Yes
		22	TASK2 specified for data output	0	0: Off 1: On	Yes	Yes
		23	TASK3 specified for data output	0	0: Off 1: On	Yes	Yes
		24	TASK4 specified for data output	0	0: Off 1: On	Yes	Yes
		29	Decimal point digit	5	0: 0 digit 1: 1 digit 2: 2 digit 3: 3 digits 4: 4 digits 5: 5 digits 6: 6 digits	Yes	Yes
		30	GATE period	1	1 to 1000 (1div: 0.1)	Yes	Yes

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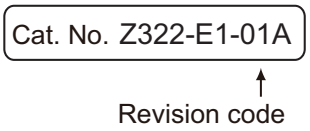
Revision History

A manual revision code appears as a suffix to the catalog number at the bottom of the front and back covers of this manual.



Revision code	Date	Revised contents
01	Feb, 2012	Original production
01A	Mar,2012	Minor corrections

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